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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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For related information see also *Astronautics*.

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Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

03 AIR TRANSPORTATION AND SAFETY 2005

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 2006

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For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications*.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 2007

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION 2009

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 2010

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

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08 AIRCRAFT STABILITY AND CONTROL 2015

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09 RESEARCH AND SUPPORT FACILITIES (AIR) 2016

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Includes powered and free-flight trajectories; and orbit and launching dynamics.

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16 SPACE TRANSPORTATION 2023

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17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING 2023

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For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 2023

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Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 2138
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 2139
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2139
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 2141
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2142
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2142
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 2144
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2145
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL 2146

Note: N.A. means that no abstracts were assigned to this category for this issue.

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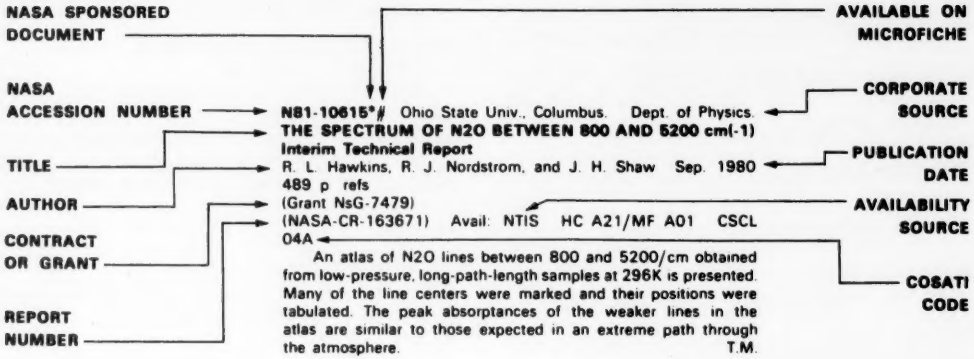
TYPICAL CITATION AND ABSTRACT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N81-10615*# Ohio State Univ., Columbus. Dept. of Physics.
CORPORATE SOURCE
THE SPECTRUM OF N2O BETWEEN 800 AND 5200 cm(-1)
Interim Technical Report
TITLE
R. L. Hawkins, R. J. Nordstrom, and J. H. Shaw Sep. 1980
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An atlas of N2O lines between 800 and 5200/cm obtained from low-pressure, long-path-length samples at 296K is presented. Many of the line centers were marked and their positions were tabulated. The peak absorptances of the weaker lines in the atlas are similar to those expected in an extreme path through the atmosphere. T.M.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, ADVANCED SINGLE STAGE FAN
D.H. Comey, Garrett Corp., AiResearch Manufacturing Co of Arizona, *402 S. 36th St., Phoenix, Arizona* 85034 (DN089859; N00140-80-C-0552)

To develop an advanced technology, high pressure ratio, single stage fan that uses an integral blade/disk design which has fewer parts than current fans. The fan will demonstrate improved durability and reliability along with the improved aerodynamic performance.

Use a mixed-flow (increasing tip diameter) design to provide a higher pressure rise capability in a single stage fan than in conventional (constant tip diameter) two-stage fan design. For durability, reduced cost and weight an integral blade/disk design has been selected for the fan. The program consists of two separate stator designs that will be tested behind the fan blade to determine best performance.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

1.0002, DOD/NASA COMPOSITE STRUCTURE REPAIR HANDBOOK
S.N. Myhre, Northrop Corp., *3901 W. Broadway, Hawthorne, California* 90250 (DF143680; F33615-79-C-3217)

Advanced composite materials are being used in military aircraft structural applications. Although structural components made of advanced composites will experience service damage, the technology to economically and reliably repair this type structure is not generally available. This program will collect and compile available data related to the repair of advanced composite structure and, when needed, conduct limited research and/or development work to fill gaps in the technology. This handbook will be used by DOD and NASA to repair advanced composite structural components on aircraft. This program will provide a single document which will be used by all government agencies in a cost-effective manner to provide greater utilization time (less repair time) for needed military aircraft weapon systems.

Completed and ongoing composite repair research and development efforts will be reviewed and collated into a complete and usable handbook. Where additional limited development work and/or testing is needed to make the handbook complete, such work will be accomplished.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0003, SECOND-GENERATION COMPREHENSIVE HELICOPTER ANALYSIS SYSTEM
I.C. Statler, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Aeromechanics Lab., *Moffett Field, California* 94035 (DA0G2725)

The objective of this task is to develop and demonstrate a second generation comprehensive helicopter analysis system which is a system of methods for predicting loads' aeroelastic stability and control, and performance for rotary wing aircraft of various sizes and rotor types. The system will be applicable in preliminary design and development support, and research activities. Accurate prediction is needed to reduce development risk for new helicopters, to prevent delays in deployment of new aircraft, and to reduce reliability and maintainability problems of operational aircraft.

A government-industry working group (GIWG) has been established to prepare specifications for the system and to define details of the approach to be taken. The majority of the work will be accomplished through contracts with industry (software firms) and grants to educational institutions. After the system is developed, it will be validated by correlation with experimental data. This program is fully coordinated with NASA rotorcraft research analysis and test plans. The rationale for this approach is to obtain maximum user involvement in the development of the system. Foreign state-of-the-art trends and potential threats to present and future systems have been considered in planning this task.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Aeromechanics Lab.

1.0004, REMOTE SENSING INSTRUMENTATION FOR GAS TURBINE ENGINES (NITRIC OXIDE)
N. Krull, U.S. Dept. of Transportation, Federal Aviation Admin., *800 Independence Ave. S.W., Washington, District of Columbia* 20590 (DN796816)

Document and explain the differences between the optical and sample extraction techniques for the measurement of nitric oxide in aircraft engine exhaust plumes.

Conduct a series of well-controlled experiments, using a series of combustion sources of nitric oxide with increasing complexity. Compare levels of nitric oxide as determined by uv and ir spectrometer and standard probe extraction methods.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

1.0005, VARIABLE GEOMETRY COMBUSTOR DEVELOPMENT
T. Clemens, United Technologies Corp., Pratt & Whitney Aircraft Group, *P.O. Box 2691, West Palm Beach, Florida* 33402 (DF462730; F33615-78-C-2043)

Design and develop a variable geometry combustor for optimized performance and emissions over its full operating range. A full annular demonstration will be developed to substantiate design interest and establish performance capabilities and limitations.

Conduct detailed component design, experimental analysis and full-scale demonstrator development. Control techniques to be studied will include flow splitting and primary and secondary mixing control techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0006, ADVANCED TRANSONIC COOLED LOW LEAKAGE TURBINE VANES
W. Mitchell, United Technologies Corp., Pratt & Whitney Aircraft Group, *P.O. Box 2691, West Palm Beach, Florida* 33402 (DF459750; F33615-78-C-2059)

Reduce turbine maintenance material costs while producing a turbine vane with enhanced performance.

Develop an improved turbine vane design methodology and apply it to the design, fabrication, and test of an advanced cooled turbine vane operating in the transonic flow regime.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0007, LOW-COST, HIGH TEMPERATURE TURBINE ROTOR BLADE

Unknown, United Technologies Corp., Pratt & Whitney Aircraft Group, *P.O. Box 2691, West Palm Beach, Florida* 33402 (DF463380; F33615-79-C-2070)

The objective of this effort is to utilize the techniques available in newer fabrication technology: This effort will address reduced production and reduced maintenance materials cost while reducing coolant flow and the attendant penalties to levels acceptable for present production engines.

A combined theoretical and experimental approach will be used. The exact unclosed equations will be studied to identify crucial statistical quantities to be measured in laboratory flows in a two-dimensional combustion chamber.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0008, HELICOPTER CONTROL SIMPLIFICATION

J.A. Stephens, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Human Engineering Lab., *Aberdeen Proving Ground, Maryland* 21005 (DA0C4935)

To determine the merits of cockpit simplification as achieved through the use of advanced primary flight controls, i.e., isometric, integrated, etc., in future helicopters which employ fly-by-wire/digital/optical control systems to reduce overall task loading.

The human engineering laboratory has demonstrated in an extensive flight test program the feasibility of the integrated helicopter control. This technology will now be applied to the examination of fly-by-wire/digital/optical helicopter control systems. Simulator and flight research will address both the mechanical and psychological aspects of advanced concepts of helicopter controls such as isometric and isotonic control dynamics and pilots' response. Previously initiated work in measuring pilot/aircraft performance in terms of fuel energy expended and in-flight occulometry will proceed, thereby enhancing the above areas of investigation.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Human Engineering Lab.

1.0009, DATCOM UTILIZATION AND IMPROVEMENT

J.E. Williams, McDonnell Douglas Astronautics Co., *E. 411 St., St. Louis, Missouri* 63166 (DF141500; F33615-78-C-3610)

A continuing effort is required to improve DATCOM coverage by refining existing methods and adding new techniques in concert with rapidly advancing technology. The object of this effort is to determine the major shortcomings of DATCOM as it applies to modern design trends and to investigate potential means of overcoming these weaknesses. A uniformly valid and complete set of prediction methods which could be used with confidence in early design would eliminate much of the uncertainty and consequent expense now associated with this phase of design.

The digital DATCOM will be used to conduct parametric studies of modern configurations, thereby assessing the value of existing DATCOM methods and the relative value of various factors involved in the calculations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0010, DYNAMIC ENGINE SIMULATOR

J. Olejack, Coastal Marine Research Inc., *Toms River, New Jersey* 08753 (DN096152)

Design and develop a working model of a dynamic engine simulator, utilizing state-of-the-art technology, which will fully simulate the actual start-up and sustained operation of a turbojet/fan engine.

The full measurement and testing capabilities of all turbojet/fan engine test systems presently in use or in production must be identified. Also, testing requirements and parameter relationships of a sample jet engine must also be identified. A mathematical model of a jet engine must be developed and a working model of a dynamic engine simulator must be designed, developed and constructed. Additional software will be developed for other engines.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Engineering Center

1.0011, SELF-REPAIRING DIGITAL FLIGHT CONTROL SYSTEM

H.B. Haake, General Electric Co., *P.O. Box 5000, Binghamton, New York* 13902 (DF146080; F33615-80-C-3600)

The objective of this effort is to exploit newly emerging system architecture strategies to significantly improve operational supportability of flight control systems for advanced military aircraft. The proliferation and projected exclusive use of digital avionics dictate that flight control systems not only be compatible with this concept but must also follow economic and operational dictates to provide improvements in overall 'supportability' including safety, survivability, maintainability, availability and life cycle cost reductions. Expected payoffs to advanced aircrafts include 20 percent hardware reduction, 15 percent reduction in life cycle cost, 18 percent survivability improvement and elimination of mission aborts (80 percent availability rate improvement).

This study will exploit newly emerging techniques and architectural concepts, such as fault-tolerant devices and networks, functional redundancy, analytical redundancy, optimal estimation and pattern recognition, which will lead to self-correction and reconfiguration strategies. An FCS design concept and criteria will be developed that place emphasis on automatic readjustment of the control system to achieve optimal performance with the available elements rather than a priori selection of alternate control laws. The program will consist of a study phase and a demonstration phase. Alternate choice FCS and airframe configurations will be evaluated during the study phase from which a baseline airframe and FCS will be selected for simulation and demonstration in the demonstration phase.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0012, FLOTATION FOR AIRCRAFT TECHNOLOGY (FLOAT) INVESTIGATION

D. Kaley, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN081424; N62269-79-C-0211)

The general objective is to provide an automatic flotation system for Navy aircraft. Such a system will be tried on board during peace-time operations and shall prevent an aircraft and its attached missiles from sinking to the bottom of the ocean following ditching or inadvertent loss from ship decks. The specific objective is to provide detailed demonstrator design, fabrication and laboratory testing for such a system. The advantage to the Navy would be rapid, low-cost recovery of politically sensitive aircraft and warheads. A secondary advantage may be realized by reconditioning recovered high-cost airframe and equipment components of new aircraft. This contract suppots work unit ZA601, Agency Accession No. DN681080.

The F14 aircraft has been selected as the investigation baseline because of its planned long service use. A final, recommended flotation configuration has been defined; next, a kit type demonstration system shall be developed, verified in the laboratory for adequacy and wet-tested for deployment capability with a surplus air frame section. This concept shall be directed toward minimum aircraft modification, weight and effect on primary mission capability. The concept will be aimed at usage on several aircraft types.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0013, MODULE DEVELOPMENT FOR THE STAGING SYSTEM

L.E. Hulbert, Battelle Memorial Inst., *505 King Ave., Columbus, Ohio* 43201 (DF138240; F33615-76-C-3125)

The use of finite element methodology in the design of structural components contributes significantly to the effectiveness and efficiency of flight vehicles. There is a need to accelerate the data handling requirements normally associated with using this methodology. The objective of this effort will be directed toward the enhancement of the Air Force staging system by providing new modules, post-processing and materials data base, not yet developed, by enhancing the display and edit and the generalized data base modules already developed, and by providing a limited number of analysis modules for evaluation of the total system. These additional capabilities will provide necessary automation of many time-consuming tasks normally associated with using the finite element methodology.

The post-processing and material data base modules will be designed, coded and integrated into the staging system. Concurrent with this effort enhancements will be made to the display and edit module and generalized data base. Finally, selected existing analysis codes will be integrated into the staging system to evaluate the system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0014, V19U FUZE LETHALITY COMPARISON

M.J. Bittakis, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141770)

This program will support ongoing laboratory survivability/vulnerability investigations. The vulnerability of a weapons system, when impacted by a cannon round, is a function of not only the incident threat but also the type of fuzing incorporated into that threat. The new threat to be studied deviates significantly from the norm. The objective of the program is to quantify and analyze lethality aspects of the new threat. It will provide sufficient data to establish weapons systems defense concepts for the new threat.

The program will be approached in the following fashion: Phase I will investigate the effects of impact obliquity and incident material thickness on the activation of fuze and high explosive warhead. Phase II will establish the activation delay-time characteristics of this type of fuzing. Phase III will compare the lethality of the V19U type threat with certain previously encountered threat types. Phase IV will investigate the results of the different lethality characteristics of this threat. This phase will incorporate a full-scale A-7 replica as a test specimen. Inlet duct damage will be the major parameter to be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0015, ANALYSIS DEVELOPMENT FOR DYNAMICS DATA REDUCTION

P.G. Bolds, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF139060)

This work unit supports the functions of the vibration and aeroelasticity facility for providing analysis of dynamics data. The broad problem is to provide state-of-the-art capabilities required for the recovery, analysis, and presentation of dynamics data which describe the operating environment of military flight vehicles and assess the accuracy of analytical prediction methods. The objective of this work unit is to integrate hardware to increase data recovery capabilities and to develop software for the analysis system that will advance the existing analysis and graphics capabilities. This will result in improved performance and advanced capabilities in the analysis of vibration and acoustic problems that occur during military operations.

The dynamics data analysis process consists of four parts: (1) data recovery and analog analysis, (2) analog-to-digital conversion, (3) digital analysis, and (4) graphic data presentation. The capabilities in the data recovery and a/d conversion areas will be increased by optimizing and upgrading the existing system components and by integrating new hardware into the system. The data analysis and graphics capabilities will be advanced by developing software and digital processing techniques to apply more sophisticated analysis procedures and to provide more graphic data presentation formats to increase the overall interpretability of the analysis results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0016, ENGINE SIMULATION FOR STORED ENERGY MANAGEMENT FUNCTION OF FLIGHT COMMAND COMPUTER FOR FIGHTER AND BOMBER AIRCRAFT

I.A. Carnegis, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF124830)

Advanced Air Force bombers and fighters are outpacing mission planning and control techniques such that the combat time becomes limited or the system grows in takeoff gross weight (TOGW) to meet combat requirements. New techniques and approaches are needed to properly manage the total stored energy of the air vehicle to assure an effective time for combat for a reasonable TOGW. Complete dynamic engine simulation is needed as an input to aircraft system simulation to develop energy management concepts and techniques. The objective of this effort is to develop a suitable engine simulation program of acceptable computer core capacity that can be integrated into a hybrid computer for energy management analysis.

This effort will evaluate the sensor concept including subscale development and evaluation of performance and environmental problems. A breadboard unit will be designed and built for laboratory demonstration and temperature read-out of the gas-temperature-density sensors. This unit, which will be operated over simulated gas turbine pressure and temperature ranges to determine performance, will generate sufficient data to permit design of a unit for an operating gas turbine engine.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0017, LAMINAR BOUNDARY LAYER SEPARATION ON AN OGIVE FOREBODY IN SUBSONIC FLIGHT AND AT VERY HIGH ANGLES OF INCIDENCE

W.H. Lane, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF144620)

This work unit supports studies of aerodynamic phenomena relating to stability and control of highly maneuverable aerospace vehicles. The particular problem area of concern is the adverse effect of extensive regions of separated flow on the stability and controllability of military aerospace vehicles. The technical objective of this work is the determination of the pattern and extent of boundary layer separation on a forebody (ogive) of wide design usage moving at high subsonic speed and at a very high angle of attack. The availability of accurate solutions of the boundary layer equations is a fundamental step in the formulation of parameterized algebraic equations for use in preliminary design studies and a necessary adjunct to time-consuming and expensive wind tunnel testing. The ability to predict the influence of forebody geometry on the pattern and position of boundary layer separation will permit an assessment of significant parameters influencing the aerodynamic design of military aerospace vehicles and their ability to perform specialized missions.

The boundary layer and other relevant flow field equations have been written in terms of a streamline coordinate system appropriate for a specific geometrical shape and Mach number regime. Numerical solution of the pertinent equations will be attempted by a suitable explicit or implicit finite difference method. Formulating or adapting an existing computer code to facilitate numerical solution of the appropriate system of partial differential equations may prove to be an unavoidable hinderance to early completion of the work.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0018, DUCT ACOUSTICS RESEARCH

D.W. Quinn, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143110)

To understand the dependence of sound levels within ducts upon such factors as duct geometry, sound absorbing properties of the duct walls, type of sound source, and flow within the duct. Specifically, to develop new aero-acoustic models and solution techniques for general duct acoustics problems. This work will be a significant contribution to the AF Aero Propulsion Laboratory's efforts to reduce turbine engine noise levels. To quote RN-AFAPL-08-72-9, 'current engine noise levels are hazardous to personnel and structures, detrimental to tactical operations and annoying to the general public.' Eventually we should be able to 'assess engine performance/noise trades' in the design of aircraft engines.

To handle variable area ducts with no flow a method of conformal mapping in conjunction with a finite difference method is used. As an alternative approach for the same problem an integral equation/potential theoretic method is appropriate. For the more general problem of variable area ducts containing fairly general flows a finite element method may be required. The acoustic equation for this general problem must be derived and an efficient numerical method must be implemented using local computer facilities.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0019, DEVELOPMENT AND DEMONSTRATION OF REMOTELY PILOTED VEHICLE AIR CUSHION LANDING SYSTEM

J.T. Steiger, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF133460)

This effort supports the development of air cushion landing systems (ACLS) for the launch and recovery of military remotely piloted vehicles (RPV). Present systems to launch and recover RPV incur high life-cycle costs, and limit rpv mobility and sortie rates. The objective of this effort is to accomplish in-house development. test and evaluation in support of the initial ground demonstration of an ACLS on the JINDIVIK drone. A RPV ACLS promises to reduce launch and recovery costs by up to 90 percent and turn-around time by up to 80 percent. Operational mobility and flexibility will be dramatically increased by a RPV ACLS. This effort will demonstrate the ground operation capability of a RPV ACLS and provide a sound basis for flight testing of the RPV ACLS.

High cost/repair items will be identified by review of available literature and personal interviews with repair crew chiefs. Specific critical repair/maintenance items will be chosen for fighter, cargo/tanker and bomber aircraft and improved stuctural design and/or repair techniques devised for each. Potential life-cycle cost savings for single aircraft and a fleet of aircraft resulting from application of the new concepts and techniques will be established.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0020, SUPERSONIC WAVE DRAG PREDICTION

R. Stancil, Vought Corp., Flight Technologies Division, *P.O. Box 5907, Dallas, Texas* 75222 (DN879006; N00167-78-C-0005)

To derive improved techniques for predicting supersonic wave drag on generalized aircraft configurations. This contract is in support of DTNSRDC work unit 1600-078, reported under DN778004.

Apply the modified linear theory method, developed by the contractor, to overcome limitations of current supersonic area rule method. The modified linear theory calculation will be programmed into a non-axisymmetric body computer routine with an input geometry definition subroutine. A graphics geometry editing routine will also be incorporated. Prepare and verify program. Furnish program decks, user's manual and user training.

SUPPORTED BY U.S. Dept. of Defense, Naval Ship Research & Development Center, Aviation & Surface Effects Dept.

1.0021, HT 79-14 - A REPRESENTATIVE SUMMARY OF THE AH-1G AERODYNAMIC AND STRUCTURAL LOADS SURVEY DATA

D.J. Merkley, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3864; N/A)

Stimulate interest in and awareness of the quality, comprehensiveness and versatility of the AH-1G operational loads survey (OLS) data bank and the data management and analysis system data-map (data from aeromechanics' test and analytics - management and analysis package), formerly known as OLS-DMS. The OLS data bank contains simultaneously recorded data from an extensively instrumented AH-1G which include blade surface pressures, leading edge stagnation data, local blade flow velocities and directions, blade accelerations, bending moments and attendant responses in the control system and airframe. The potential of the OLS data bank with respect to the Army's needs will be realized through increased interest and awareness.

Survey selected aerodynamic and structural data with corresponding flight-test conditions for representative steady-state and transient maneuvers convering the range of the OLS flight envelope. The resulting set of reduced data will be documented in plotted format utilizing data-map to illustrate the extent of flight conditions and magnitude of the various types of data available.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0022, RESEARCH IN STRUCTURES

J.L. Shipley, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Research & Technology Lab., *Hampton, Virginia* 23665 (DA0E3550; N/A)

To conduct basic research for fundamental structures and materials application technology necessary for a viable structures program. Efforts include analytical techniques for complex structures, development of fatigue and fracture mechanisms in composite materials, the demonstration of advanced materials on helicopters, and the improvement of prediction techniques for structural dynamics.

In conjunction with NASA-LRC, analytical techniques for complex structures will include the application of minicomputers in finite element analysis and participation in the IPAD program. In the analysis and prediction of fatigue and fracture composites, experimental data will then be incorporated into a statistical model for fatigue behavior of graphite epoxy. Environmental effects on fatigue will be continued. The evaluation of environment effects and durability of composite components in a service environment and comparison to specimens under the same environment will be initiated. The composite fuselage investigation will continue, a program to develop an efficient technique for attachment of hard-points to an all-composite panel. The crash impact energy absorption capability of composites will be compared to conventional sheet metal construction designed to the same static strength requirements. Fuselage structural dynamics will explore other finite element techniques to helicopter dynamic response.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0023, ADVANCED EJECTION SEAT FOR HIGH DYNAMIC PRESSURE ESCAPE

R.F. Yurczyk, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF143320; F33615-79-C-3406)

This work unit will support projected manned fighter aircraft designs in which expending escape performance envelopes and integration of the excape systems with advanced cockpit configurations are critical problem areas. Current crew escape statistics reveal that approximately 45 percent of the ejections result in major or fatal injuries to the crew. The performance, mission profiles, maneuvering capabilities and design characteristics projected for future aircraft increase the potential for escape in more hazardous areas of the flight envelope. The objective of this work unit is to develop an advanced ejection seat

escape system design capable of successful operation at dynamic pressures up to 1600 psf and functional compatibility with advanced cockpit designs. The emphasis on escape system performance will be stability, acceleration protection, wind blast protection and limb flail protection. The need to increase the safe crew escape capability applies to current fighters, near-term derivatives and the fighter configurations projected for the future.

Conduct a wind tunnel investigation and performance prediction analysis on selected ejection seat configuration concepts which were generated in a recently completed FY77 LDF program. Refine the configuration as required with emphasis on acceptable ejection loads on crew and on cockpit integration considerations. Fabricate a working mock-up to demonstrate wind blast protection, restraint and crew station integration techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0024, NAVY VEHICLE DESIGN AND CONSTRUCTION - FINITE VOLUME METHODS FOR THREE-DIMENSIONAL TRANSONIC FLOW

J. Mercer, Flow Industries Inc., *21414 68th Ave. S., Kent, Washington* 98031 (DN875175; N00014-80-C-0453)

Accurate prediction of three-dimensional flows about wings and bodies is essential for the design of cost-effective and high performance military aircraft. Recent developments in numerical finite volume methods have led to the potential capability of computing such flows in the complex transonic regime for realistic aircraft wing/body shapes. It is the objective of this investigation to develop this potential into a useful and effective analysis tool for use in aerodynamic research and design.

A preliminary wing/body program will be developed using a finite volume method to solve the full potential equations for a wing and a closed body with a noncircular fuselage in transonic flow. A new imbedded mesh system will be implemented to permit flow field computations for wing/body/horizontal tail configurations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0025, LEADING EDGE DESIGN STUDY FOR SWEPT-BACK SLENDER WINGS WITH OR WITHOUT SEPARATION

R.K. Nangia, University of Bristol, *Bristol, England, United Kingdom* (DF140640; AFOSR-77-3243)

In the design of high performance fighter aircraft having large wing sweep, compromises occur in meeting the constraints of efficient high speed cruise and good transonic maneuverability. Careful design of the leading edge geometry can lead to significantly improved wing performance (lift-drag ratio) in both speed regimes. Applying droop in the leading edge region by means of flaps, variable camber devices, or slats can lead to improvements although in general optimum geometric shapes must be found by trial and error. Leading edge design is further complicated for this class of wings by the possibility of flow separation and subsequent vortex formation. The object of the study is to provide guidelines to be used in designing leading edges of high-sweep wings in order to achieve the maximum aerodynamic efficiency.

A theoretical method will be developed to calculate the flow field for non-planar, highly swept wings of finite thickness having either separated or attached flow at the leading edge. The problem will be simplified by making the assumption of conical flow thereby allowing the problem to be reduced to a 2-D solution in the cross-flow plane in which conformal transformation techniques can be introduced. Leading edge separation will be analyzed with a Brown and Michael-type model for the free, rolled-up vortex sheet. This relatively simple approach will provide the means to investigate the details of the flow near the leading edge for a large number of cases at mimimum computational cost.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, EROSION MECHANISMS OF METALS

M.E. Gulden, Solar Turbines International, Research Laboratories, *2200 Pacific Hwy., San Diego, California* 92138 (DF053130; F49620-78-C-0104)

AF function - aircraft turbine engines are required to operate in global situations involving dust, sand, ice and other airborne solids. Deficiency - particulate ingestion results in the erosion of turbine air foils and reduces the efficiency and power. Objective - the objective of this research is to formulate and examine a general theory of erosion based upon the ductile/brittle properties of the material. How work contributes - this research will lead to more erosion-resistant turbine materials. Of particular interest will be the new intermetallic alloys, DS eutectics and new coatings developed for turbine applications.

The baseline erosion characteristics of five steels will be determined as a function of heat-treated hardness. Critical erosion and environmental test variables will be tightly controlled to define the effect of specific material properties on the erosion mechanisms. The threshold for erosion of a single composition will be determined as a function of its ductile-to-brittle transition, angle of impingement, particle size and velocity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0002, LOW RESISTIVITY/HIGH LIFE-TIME SINGLE CRYSTAL SILICON INVESTIGATIONS

R. Opjordon, Spectrolab Inc., *12500 Gladstone Ave., Sylmar, California* 91342 (DF461400; F33615-77-C-2045)

The objective of this program is to improve N plus/P silicon solar cell performance through the improvement of moderate to low resistivity single crystal silicon material.

Reduce levels of non-desirable impurities (Fe, C, Ni, etc.) in single crystal silicon, establish methods to introduce pure electrical dopants (both in bulk and PP (plus) and N (plus)/P junctions), and fabricate and test cells.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0003, MOLECULAR BEAM ELECTRIC RESONANCE SPECTROSCOPY OF IONIC MOLECULAR COMPLEXES

J.S. Winn, University of California, Berkeley Campus, School of Letters & Science, Dept. of Chemistry, *Berkeley, California* 94720 (CHE77-21915)

The equilibrium intermolecular potential between two molecules or an atom and a molecule, one of which (or both) contains a highly ionic bond, will be investigated by the molecular beam electric resonance spectroscopy of molecular complexes bound by such an intermolecular potential. The alkali halide dimers, the argon-alkali halide triatomics, the alkali metal triatomics, the argon-dialkali triatomics, and the chemically bound noble gas dihalides will be the species of primary interest during these studies. These species will be formed in a supersonic molecular beam and detected by both positive and negative ion mass spectroscopy, utilizing the phenomenon of dissociative electron attachment to molecular clusters to generate the negative ions. Electric resonance spectroscopy will be performed in the microwave and radio frequency regions. Theoretical calculations which indicate the types of structures expected in these studies, and additional calculations of ionic molecular complexes, will be performed during the course of this work.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0004, BASIC SURFACE STUDIES FOR ELECTRONIC DEVICE MATERIALS

G.A. Haas, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN580201)

To study surface and interface properties of materials for use in electronic devices such as reliable microwave tubes, electron emitters, MIS devices and thermionic energy converters. Examples are low surface potential materials, semiconductor layers and insulating films, and amorphous materials.

Surface techniques such as retarding potential methods, scanning low energy electron probing (SLEEP), auger electron spectroscopy (AES), low energy electron diffraction (LEED), sputter profiling, attenuated and total optical reflection, and low energy electron reflection (LEER) are combined with in situ evaporation and film fabrication. These methods will be used to study basic mechanisms such as atomic dipoles, surface states, interfacial analysis, and surface potential characteristics. Current application is to alkaline earth oxides, Ba scandate and Os coatings.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

3.0005, WELDING METALLURGY

E.A. Metzbower, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN780032)

Correlations between properties and structures have been well-developed for base metals but are tenuous for weldments. The objective of this task is to correlate the mechanical properties of weldments, especially weld metal and heat-affected zone properties, with their structures, i.e., micro- and macrostructures. Such knowledge and data would then serve as guides in the improvement of existing naval weldments and in the development of future naval weldment systems.

The program is aimed primarily at developing welding parameters for laser weldments of high strength steels, aluminum and titanium alloys, measuring the mechanical properties of these weldments, determining the structures, hardness values and cracking mechanisms, and correlating these data with established laws of physical metallurgy. Such data and correlations that evolve from the program will be compared to known data from more conventional welding processes.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

3.0006, SUSTAINED LOAD CRACKING IN TI ALLOYS

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To establish the role of major metallurgical variables on sustained load cracking and to postulate a mechanism for this phenomenon. This will provide relevant information pertaining to the design and reliability of critical components in Navy systems.

In order to determine the characteristics of sustained load subcritical crack growth in Ti-6Al-2CB-1Ta-0.8Mo alloys, the material variables will consist of three hydrogren concentrations, three distinct microstructures, four different environments, four test temperatures for each hydrogen concentration and two processing procedures, beta-processed and alpha-beta-processed. Two preferred crystallographic orientations will be studied if texture development is significant. Tests will be performed to quantitatively evaluate tensile properties, stress intensity factors, and time-dependent crack growth rates. Optical and electron microscopic examination will be performed to determine the mode of fracture.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0007, DETERMINATION OF FATIGUE AND STRESS CORROSION DAMAGE FROM X-RAY LINE PROFILES

J.B. Cohen, Northwestern University, Evanston Campus, Technological Inst., Dept. of Material Sciences, *633 Clark St., Evanston, Illinois* 60201 (DN075083; N00014-80-C-0116)

The service life of critical naval components such as gears, bearings, and helicopter blades depends on the fatigue resistance developed by heat treatment and surface processing. This program will investigate the nature and effects of residual stresses on the fatigue behavior of metal alloys.

Improvements in the X-ray method of measuring residual stresses will be an important part of this program with the new emphasis on correcting for errors in the stress measurement due to the existance of near subsurface stresses normal to the surface. Stability of surface compressive stresses will be examined in samples undergoing fatigue loading. Stresses in the plastic zone ahead of a crack will be measured by a fine X-ray beam and by neutron diffraction, which offers in-depth analysis capabilities.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0008, HIGH ENERGY ELECTRON IMPACT SPECTROSCOPY

R.A. Bonham, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Chemistry, *Memorial Hall, Bloomington, Indiana* 47401 (CHE80-00253)

This research is in the area of quantum chemistry. High energy electrons with kinetic energies ranging from 2 keV to 60 keV will be used to probe atomic and molecular electronic structure by analysis of the angular and energy distributions of scattered electrons. The experiments consist of a well-defined electron beam scattering from a gaseous target in the form of a localized gas jet with subsequent energy analysis of the scattered electrons. The planned spectral studies will focus on valence shell electron impact spectroscopy, inner shell electron impact spectroscopy including investigations of Extended X-Ray Absorption Fine Structure (EXAFS) and elastic scattering. In all cases the angular or momentum transfer dependence of each feature of the energy loss spectrum will be investigated. Such studies are unique to the high energy electron impact spectroscopy approach and often yield important new information. In addition, in order to place all results on an absolute scale, the complete energy loss spectrum will be observed and the generalized oscillator strength obtained. This will also allow determination of numerous properties of the system under study by use of well-known sum rules. Large angle (5 degrees-15 degrees) studies of the inelastic scattering will be employed to determine Compton profiles and momentum densities. The angular dependence of the total inelastic scattering and the elastic scattering over the angular range of 0-5 degrees will be used to determine quantities related to the one and two electron charge densities of the target. This research represents continuation of that supported by Foundation Grant CHE7683683.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0009, MIXED CONDUCTION IN IRON DOPED BETA'-ALUMINA

R.W. Vest, Purdue University, School of Engineering, Dept. of Materials & Electrical Engineering, *Executive Bldg., West Lafayette, Indiana* 47907 (DMR78-25236)

This program will be a study of ionic and electronic conductivities in beta'-alumina doped with varying amounts of iron. The defect structure will be established, and the interactions between electronic and ionic charge transport will be determined. The feasibility of using such doped alumina materials as solid solution electrodes and as a cathode for sodium/sulfur batteries will be investigated.

This is a continuation of research initiated under NSF Grant DMR76-02637A01, and is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0010, A PROGRAM LEADING TO SPECIFICATIONS FOR AVIATION TURBINE FUEL PRODUCED FROM WHOLE CRUDE SHALE OIL

W.A. Sutton, Ashland Oil Inc., *1409 Winchester Ave., Ashland, Kentucky* 41101 (DF463890; F33615-78-C-2080)

The objectives of this program are to optimize new procedures for the efficient and economic processing of whole crude shale oil into high yields of military fuels while maximizing the

yield of aviation turbine fuel and to determine the tradeoffs between jet fuel yield, jet fuel properties, and processing costs.

The proposed program will be a 28-month effort incorporating all the following aspects: (1) process variable analysis, (2) analysis of laboratory samples, (3) production of component test samples, and (4) overall economic optimization by computer model.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0011, BONDED ALUMINUM CORROSION INHIBITION

J.D. Venables, Martin Marietta Corp., Martin Marietta Laboratories, *1450 S. Rolling Rd., Baltimore, Maryland* 21227 (DN075579; N00014-80-C-0718)

Various techniques are in use to modify the surface of aluminum prior to formation of an adhesive joint, in order to improve joint strength and durability. Joined aluminum structures are of interest in naval aircraft to improve reliability and reduce weight by replacing riveted joints with bonded joints. The aluminum oxide is, however, attacked by moisture and is converted to the hydroxide which has inferior properties. An inhibitor has been found which hinders the conversion. This task will determine the process of inhibition and the optimum condition for improved initial and long-term bond strength.

Aluminum alloys in common aircraft use will be subjected to various oxide preparation techniques, characterized, coated with an oxide-hydroxide conversion inhibitor under various conditions, characterized, then formed into an adhesive joint. The joint will be subjected to wedge tests to gain information on initial strength and durability of the joints in order to develop a better understanding of the basic mechanisms involved.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0012, THERMODYNAMIC PROPERTIES OF LIQUID SILICATES, MATTES AND SALTS

J.F. Elliott, Massachusetts Inst. of Technology, School of Engineering, Dept. of Materials Science & Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DMR79-23671)

This is a study of the thermodynamic behavior at elevated temperatures of constituents in certain non-metallic phases that are important in process metallurgy and hot corrosion of metals and ceramic materials. The work will include measurements on the behavior of sodium oxide in liquid acidic silicates, on the properties of oxygen and sulfur in liquid copper-iron mattes, and on the behavior of sodium oxide and SO3 gas in certain liquid sodium oxide-metal oxide systems: Na2O-NO3-SO3, Na2O-MoO3, Na2O-V2O5-SO3 and Na2O-PbO-SO3. The effects of additions of sodium chloride to these last named systems will also be studied. The program will include work on modelling the behavior of the constituents in these liquids both from empirical and fundamental points of view. The results of the research should provide information on the fundamental behavior of constituents of liquids that are important in the field of metallurgy. This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0013, STRENGTHENING MECHANISMS IN TITANIUM ALLOYS

D.A. Koss, Michigan Technological University, School of Engineering, Dept. of Metallurgical Engineering, *Houghton, Michigan* 49931 (DN223465; N00014-76-C-0037)

The high strength-to-weight ratio and corrosion resistance of titanium alloys make them highly desirable for use in aircraft and submarine structures. This research effort will examine mechanisms of plastic flow in titanium alloy sheets and complicating effects of crystallographic texture and hydrogen atmosphere.

Titanium sheets with strong textures that influence through-thickness deformation will be deformed under uniaxial and multiaxial loading to examine the mechanisms of slip, strain localization, and fracture. Alpha and alpha-beta titanium alloys will be compared and the influence of hydrogen on the deformation and fracture process noted. Biaxial loading will be accomplished by punch pressing and by internal pressurization of tensile-loaded tube specimens. Testing variables include strain-rate, hydrogen level, microstructure and texture.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0014, STUDIES OF THE ENERGY STATE OF PRODUCTS OF HETEROGENEOUS REACTIONS ON WELL-CHARACTERIZED METAL SURFACES

S.L. Bernasek, Princeton University, Graduate School, Dept. of Chemistry, *205 Nassau Hall, Princeton, New Jersey* 08540 (CHE79-09467)

This grant supports research under the Structural Chemistry and Thermodynamics Program for experimental studies of the energy distribution in molecules formed during reactions at metal surfaces. Professor Bernasek will extend the electron-beam induced-fluorescence technique as a method for measuring the rotational energy content of nitrogen molecules desorbed from an iron surface. These molecules form as the result of recombining nitrogen atoms. Bernasek will also measure rotational energies of nitrogen molecules formed at molybdenum surfaces. Catalytic reactions involving carbon monoxide and ammonia oxidation will also be studied with the objective of measuring the internal energy content of various product molecules.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0015, SYNTHETIC AND PETROLEUM FUEL DEVELOPMENT

C.J. Nowack, U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center, Fuels Lubes & Power Drive System Group, *1440 Pkwy. Ave., Trenton, New Jersey* 08628 (DN889800)

To develop the capability of operating Navy aircraft on synthetic and nonstandard petroleum fuels by determining the impacts of changes in fuel properties on aircraft systems and support systems.

Conduct a laboratory program that will physically define the meaning of critical fuel properties as pertaining to performance of aircraft component hardware. This work includes tests of components with various fuels; studies of the effects of refining procedures on fuel properties; and tests of fuel properties that impact on aircraft fuel storage and use.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

3.0016, THE HERBERT P. BROIDA PRIZE FOR RESEARCH IN ATOMIC AND MOLECULAR SPECTROSCOPY OR CHEMICAL PHYSICS

W.W. Havens, American Physical Society Inc., *335 E. 49th St., New York, New York* 10017 (DN075001; N00014-80-G-0004)

New discoveries in basic as well as in applied research and new understandings achieved by careful and imaginative research will always be a matter of interest to the Navy. Herbert Broida was well known both as a principal investigator and as a scientific consultant to the DOD. This task will contribute to an award which has the objective of encouraging outstanding scientific research work and disseminating important information in the fields of atomic, molecular and chemical physics.

This task is to furnish support for the sponsoring of two annual prizes in honor of Herbert P. Broida to be awarded in 1980 and 1981. The prizes will be awarded at ceremonial sessions of the American Physical Society general meeting.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0017, PROTECTIVE OXIDE FILMS

R.K. MacCrone, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Materials Engineering, *110 8th St., Troy, New York* 12181 (004779 TICNO; 272(02R)2308(34C))

Continued work is proposed on the investigation of point defects in protective oxide films. Thermogravimetric and resist-

ance relaxation techniques will be used together with selected physical techniques (photoconductivity, charge injection, and thermoluminescence) to monitor the defect state of the film. A comparison of these two complementary approaches will be made. Advances in the understanding and the control of protective films are expected. The results include a description of: (1) the construction of a thermogravimetric facility, (2) the growth and characterization of CVD single crystal NiO films, (3) I versus V measurements at different temperatures, and (4) I versus t curves at different voltages.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research, Office of Basic Energy Sciences

3.0018, DETERMINATION OF MOLECULAR EXCITED STATE PROPERTIES BY MULTIPHOTON IONIZATION SPECTROSCOPY

P.M. Johnson, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Chemistry, *Stony Brook, New York* 11790 (CHE79-50004 A014)

Multiphoton ionization spectroscopy will be used to provide information about the structure and the time evolution of some molecular excited states. Usually these molecules will be contained in a supersonic expansion which cools them to a very low rotational temperature, providing simplification of the spectra and the excitation mechanism. Specific studies are planned of a recently discovered collisional and off-resonance laser-induced population of molecular excited states. High resolution spectra of molecules such as CS2, CO2 and benzaldehyde will be recorded in order to more precisely determine structural and interaction properties of both excited singlet and triplet states. In addition, the excited state evolution in time will be studied for molecules such as benzene and toluene by observing the multiphoton ionization-induced mass spectrum as a function of time after the initial creation of an excited vibronic level. It is expected that information will be gained about long-standing problems such as the end-product of 'channel three' in benzene and the mechanism of intersystem coupling in other aromatic molecules. This research represents a continuation of that currently supported by Foundation Grant CME 7708346.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0019, IDENTIFICATION AND QUANTIFICATION OF WATER-SOLUBLE COMPONENTS OF JP4

J.D. Brammer, North Dakota State University, School of Science & Mathematics, Dept. of Zoology, *Fargo, North Dakota* 58102 (DF053550; AFOSR-78-3709)

AF function - the Air Force consumes 225,000 barrels of JP-4 each day. Transport of this fuel as well as routine operations have resulted in the contamination of aquatic environments with JP-4. Water-soluble components of this jet fuel may affect man through drinking water supplies, accumulate in food chains and be detrimental to aquatic ecosystems. Deficiency - little information is available on the biological and environmental fate of water-soluble components of JP-4. Objective - the objective of this research is to identify and quantify the water-soluble components of JP-4 and to determine the biological effects of those constituents on aquatic biota. How research contributes - results of this study will provide information necessary to establish realistic guidelines regarding release of JP-4 into aquatic ecosystems. This research directly supports subarea 1.8, environmental protection and toxicological hazards, and ro's 1.8.1 health effects and 1.8.5 predictions of environmental impact.

Water-soluble components of JP-4 will be identified. Quantitative measurements of individual components will be made over time under different water salinities, temperatures and states of physical agitation. Acute toxicity tests using individual components, both singly and in combination, will be conducted using selected freshwater organisms. Biological effects of sublethal exposures will be measured by studying effects on reproductive capacity, development, growth, behavior and respiration. Uptake, accumulation and depuration of JP-4 components will be examined in selected aquatic species.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0020, OPTICAL STUDY OF GAS-PHASE IONS

R.C. Dunbar, Case Western Reserve University, Graduate School, Dept. of Chemistry, *2040 Adelbert Rd., Cleveland, Ohio* 44106 (CHE78-06604)

This research falls in the area of chemical dynamics. Aspects of the interaction of light with gas-phase ions will be investigated. Ion cyclotron resonance spectroscopy will be the principal tool used in conjunction with several laser light sources. The dissociation of gas-phase ions by absorption of two or more photons of light, in both the visible and the infrared regions of the optical spectrum, will be studied in regards to the dissociation process itself and also ion-neutral collision processes. Additionally, spectroscopy of a number of organic cations and rearrangements occurring among various structures of ions will be studied. This work is a continuation of that currently supported by Foundation Grant CHE 7513770.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0021, COMPOSITES FOR STRUCTURAL DESIGN

H. Cherry, Texas A & M University, College Station Campus, Texas Engineering Experiment Station, *College Station, Texas* 77843 (DF051210; F49620-78-C-0034)

AF function - improved aerospace vehicles are possible through the use of advanced composites and associated innovative design concepts. Opportunity - improved understanding of the performance and characterization of advanced composites will enhance Air Force technology applications. Objective - the objective of this research effort is to develop a basic understanding between the parameters which characterize advanced composites and composite structural performance. How work contributes - results from the studies undertaken during this program will assist the Air Force in future composite aerospace vehicle development, e.g., AFTI.

Research being conducted under this contract will be pursued along three phases to achieve the stated objective. Parameters which control the mechanical behavior of a laminate will be investigated. Processing characteristics will be studied, such as pressure temperature, hold-time rates, etc., in order to quantitatively study residual stress behavior strength, stiffness and fracture characteristics. In addition, diffusion processes will be examined, both theoretically and experimentally, in conjunction with the above, to delineate degradations which occur due to exposure to hostile environments, in particular, elevated temperature and high humidity. Finally, techniques will be examined and developed which have the potential to nondestructively examine laminates in order to a) insure quality, b) characterize defects, and c) yield quantitative data on diffusion processes. Neutron radiography will initially be pursued in this approach.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0022, ELECTROMIGRATION IN ALUMINUM ALLOY FILMS

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The objective of this study is the development of fundamental physical information needed to assess and predict the electromigration of thin film binary and ternary aluminum alloys used as solid-state device interconnection paths.

Test structures incorporation aluminum alloy conductive films will be coated with deposited dielectric layers and subjected to a series of current density and temperature stress. Information will be obtained on the rates of electromigration failure due to both open-conductor stripes and resistance changes due to dopant atom redistribution. These failure mechanisms will be related to stripe composition and geometry and also the integrity of the overlying dielectric layer. Study results will be combined with existing information on silicon-doped aluminum films and

used to develop improved test methods and specifications for high reliability microelectronic devices. The end-item will be a report.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

3.0023, ELECTRON SPECTROSCOPY OF SEMICONDUCTOR HETEROJUNCTION INTERFACES
M.G. Lagally, University of Wisconsin, Madison Campus, School of Engineering, Dept. of Metallurgical & Mineral Engineering, *Madison, Wisconsin* 53706 (DN775535; N00014-77-C-0474)

The operational properties of solid-state electron devices used in Navy electronic systems are often dominated by the electronic effects occurring at various solid surfaces and solid-solid interfaces. Understanding and controlling the surface effects are essential to improving performance and reliability.

Using surface analysis techniques such as auger spectroscopy, low energy electron diffraction and X-ray photoemission spectroscopy, the investigator will probe the local electronic properties of surface atoms. These atoms may represent the host material, absorbed impurities, or atoms of an adjacent host material such as occurs in the semiconductor-semiconductor heterojunction. Determination of the local density of states at each atom will permit evaluation of the effects of impurities or surface states on the overall electronic nature of the surface. Of particular interest is the nature of the energy discontinuity which appears at the heterojunction interface and the changes in local density of states as a result of surface disorder and oxidation.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0024, CRYSTALLOGRAPHIC DETERMINATION OF LIMITATIONS TO ORDER IN SURFACES AND OVERLAYERS
M.G. Lagally, University of Wisconsin, Madison Campus, School of Engineering, Dept. of Mineral & Metallurgical Engineering, *Madison, Wisconsin* 53706 (DMR78-25754)

Knowledge of their geometric structures is fundamental to understanding all other properties of surfaces, and of overlayers grown on them. The simplest, and often used, assumption is that surfaces are 'perfect': perfect checker-boards of infinite size. Defects (such as point defects, strain-fields, steps, orientational domains, or low-angle grain boundaries), however, do exist and can strongly influence electronic properties, kinetic properties, and the processes they control: crystal growth and epitaxy, oxidation, and surface chemical reactions and catalysis.

The purpose of the present work is to develop and use the Low Energy Electron Diffraction (LEED) technique for studying the role of defects in determining the degree of ordering of surfaces and adsorbed layers. Under study are: experimental limitations to, and improvements of, the technique; clean surfaces of monocrystalline thin films, or of damaged single crystals; chemisorbed layers and island growth; and model calculations for interpreting these LEED data. Systems of interest include copper, silver, nickel, palladium, and/or platinum surfaces with various chemisorbed species.

This is a continuation of work supported by DMR76-24221. It is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0025, MEASUREMENT OF THERMAL DIFFUSIVITY OF CARBON/CARBON FIBER COMPOSITES FROM 20-3000 DEGREES C
R. Taylor, University of Manchester, University of Manchester Inst. of Science & Technology, *Sackville St. 1 Lancs, P.O. Box 88, Manchester, England, United Kingdom* (DF050060; AFOSR-77-3449)

AF function - weapon delivery. Deficiency - in order to design, develop and evaluate carbon/carbon composites for use in reentry vehicles and rockets, the transport properties must be determined to accurately refine the temperature field, and calculate the thermal response, within nose tips, heat shields, and rocket nozzles. Objective - in this research, detailed experimental data will be obtained and used to derive an analytical model which relates thermal diffusivity at temperatures up to 3300 degrees K to matrix properties, fiber volume and orientation, and pore structure of carbon/carbon composites. How work contributes - if a successful model is obtained, it will go a long way toward satisfying the noted deficiency. But in any case, the reliable thermal diffusivity data will in themselves be useful to AF technology.

Using the laser heating pulse method already developed at the University of Manchester, thermal diffusivity from ambient to 3300 degrees K will be measured for carbon/carbon composites of various geometries, fiber type and matrix properties. Samples, and all available information relative thereto, will be furnished by AFML. Additional characterization will be obtained by the contractor through metallography, electron microscopy and X-ray diffraction. Correlation of measured thermal diffusivities with structures and other properties, leading to semi-empirical heat transport models, will be carried out.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0026, MICROANALYSIS OF ATOMIC CLUSTERING IN ELECTROMAGNETIC MATERIALS
R.S. Tebble, University of Salford, *The Crescent, Salford, England, United Kingdom* (DF056580; AFOSR-80-0005)

AF function - advances in command, control and communications depend directly upon the reliability and performance of electromagnetic devices which are in large measure dependent upon the solid-state electromagnetic materials of special and unique properties and behavior. Opportunity - special high resolution electon optical techniques and instrumentation provide a timely opportunity to investigate the electronic and magnetic microstructures and phases as well as the crystallographic features, defects and interfaces of a variety of materials used and needed in solid-state electromagnetic devices. Objective - the aim of this research is to microanalyze atomic clustering of dilute impurities in selected electromagnetic materials such as metallic spin glasses and dilute alloy semiconductors. How work contributes - these investigations should result in a more precise resolution of impurities defects and stacking faults in the solid-state materials used in electromagnetic devices and should therefore lead to a better understanding of submicron structures in very large scale and very high speed integrated circuit technology.

Novel methods and techniques of high-resolution high-voltage scanning and transmission electron microscopy and selected-area electron diffraction analysis, as well as more conventional ctystallographic and morphologic structural analysis wll be utilized in this investigation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, UTILIZATION OF DISTURBANCES IN DISCRETE-TIME CONTROLLERS
C.D. Johnson, Dynamic Systems Research & Training Corp., *Huntsville, Alabama* 34802 (DA0G3006; DAAH01-80-M-0091)

Develop theoretical base and algorithms for the disturbance-utilization mode of disturbance-accommodating control theory in a discrete-time problem. Develop algorithms for disturbance-absorption of selected state variables in discrete problems. Develop algorithm for discrete disturbance absorption using a first-order hold sampler.

Synthesize the control algorithms and the estimator algorithms for each discrete-time design objective listed above.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Guidance & Control Directorate

4.0002, ELF PROPAGATION EFFECTS
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In Navy ELF radio propagation measurements, unexplained amplitude degradation on high latitude paths has occurred frequently. The problem may be caused by precipitation of high energy ions and electrons into the lower d-region ionosphere. An accurate assessment of the cause and level of disturbance is needed to allow analytical prediction of propagation losses under specific conditions.

Energetic electron and ion precipitation data from coordinated satellite and incoherent scatter radar measurements taken during the August 1972 solar particle event (SPE) and during relativistic electron precipitation (REP) events will be analyzed to determine ionospheric height profiles of electron and ion densities. These profiles will be used in 2-dimensional radio propagation prediction computer codes and the results compared with ELF radio propagation records for the same times. The preliminary planning and organization for a field program to measure directly the conductivity of the atmosphere below 40 km will be done.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0003, COMMUNICATIONS - CHARGED PARTICLE ACCELERATION IN THE INNER MAGNETOSPHERE
W.P. Olson, McDonnell Douglas Astronautics Co., *5301 Bolsa Ave., Huntington Beach, California* 92647 (DN875382; N00014-80-C-0796)

The precipitation of energetic magnetospheric particles during geomagnetic disturbances degrades or disrupts the performance of naval communications, navigation, and surveillance systems with operating frequencies ranging from the ELF to the SHF bands. Those precipitating particles, originally of solar wind origin, are accelerated by more than an order of magnitude within the magnetosphere. The purpose of this study is to investigate the processes responsible for this acceleration, and which are not currently understood. An understanding of these processes is required to successfully develop a dynamical physical model to predict the occurrence and effects of geomagnetic disturbances.

The sophisticated model of the geomagnetic field developed previously by this group will be used to quantitatively determine the entry of solar wind particles due to magnetic field gradients. The build-up of space charge will be used to calculate the cross-tail electric field and current, which will be compared, for consistency, with the tail magnetic field model.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0004, AURORAL-REGION DYNAMICS DETERMINED WITH THE CHATANIKA RADAR
V.B. Wickwar, S R I International, *333 Ravenswood Ave., Menlo Park, California* 94025 (DF050570; F49620-78-C-0018)

AF function - the high latitude ionosphere impacts upon numerous Air Force missions. SAMSO, ESD, and AWS all have stated needs for modeling of the ionosphere. Deficiency - the time/space scale of rocket probes has permitted little understanding of the neutral dynamics of the ionosphere. Yet these winds transport energy and chemistry, and interact directly with the plasma. Objective - to determine the altitude and time-dependence of the quasi-steady-state e and f region neutral winds, to investigate the correlation between dynamical and precipitating particle effects and the departure of neutral winds from their quiet-time value, and to investigate the use of the radar to investigate gravity waves. Contributions - to better understand the neutral dynamics contribution to the energetics of the northern latitude ionosphere.

Archived Chatanika incoherent scatter radar data will be analyzed to determine neutral winds in the e and f regions. Case studies when ion drag, joule and particle heating data are available will be correlated with the neutral wind perturbations to better understand the energetics and dynamics of the high latitude ionosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0005, PROBLEMS IN LARGE-SCALE DYNAMIC SYSTEMS
E. Tse, Stanford University, School of Engineering, Dept. of Engineering Economic Systems, *Stanford, California* 94305 (DN575179; N00014-75-C-0738)

Large-scale systems theory is increasingly being used to model problems of defense interest such as C3 and the design of defense networks. This task will contribute to a better understanding of large-scale system design issues related to information structuring or information exchange in the system. This is important due to the need to limit communications in the system and to avoid burdening the decision-maker with more data than he can handle.

This task will investigate information structuring in distributed control systems, dynamic hierarchical games and dynamic coalitions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0006, COMMUNICATIONS - VLF MAGNETOSPHERIC PROPAGATION AND WAVE-INDUCED PRECIPITATION EFFECTS
R.A. Helliwell, Stanford University, Stanford Electronics Lab., Dept. of Electrical Engineering, *Stanford, California* 94305 (DN623870; N00014-76-C-0689)

Particle precipitation produces disruption of naval communication, navigation, and radar systems, including sudden phase anomalies and absorption of ELF and VLF signals, HF fading, and VHF and UHF scintillation. The objective is to study VLF propagation into and within the magnetosphere, the wave particle interaction responsible for the precipitation, the effects on the ionosphere, and on ionospheric propagation.

Theoretical analysis and modelling results are compared with experimental measurements of Navy VLF signals, natural whistlers, Siple transmissions, and signals generated by power line harmonics. VLF propagation through the ionosphere and its interaction with magnetospheric electrons is being investigated. The cause of extremely large (about 60 degrees) deviation between measured angle of arrival and subionospheric VLF waves and the great circle direction is being sought.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0007, REMOTE SPATIAL ORIENTATION AND POSITIONING DISPLAY
D.C. Smith, U.S. Dept. of Defense, Navy, Naval Ocean Systems Center, Environmental Sciences Dept., *San Diego, California* 92152 (DN087510)

Provide an operator with the capability to sense a remote vehicle's spatial orientation and position through a sensory channel other than vision.

Remote systems operators faced with both active and passive locomotion perceptual cues almost completely depend on the visual sense to close the system's feedback loops in order to maintain control. The approach is to provide a parallel sensory channel that will support the visual sense and provide the operator with correlated sensory inputs. The result will enable a remote systems operator to achieve a 'sensory' feeling of well-being that will allow him to attend to the more relevant visual cues, thus increasing operator performance. Two 32-channel tactile display belts will be interfaced with a microprocessor and investigations will be made into their use to provide an operator with 'sense of direction', translation, rotation, and velocity cues.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

4.0008, AUTOMATIC TEST TECHNIQUE DEVELOPMENT FOR ADVANCED ELECTROOPTICAL SYSTEMS
J.J. Kovak, U.S. Dept. of Defense, Navy, Naval Weapons Center, *China Lake, California* 93555 (DN096153; N68335-79-P-098020)

Develop and recommend automatic test techniques for advance electrooptical systems and subsystems. Develop testability guidelines for future electrooptical avionics systems.

Support concepts and ground support equipment requirements must be considered at design inception. New testing techniques/concepts and test interface requirements developed will be included in development specifications for future electrooptical avionics systems.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Engineering Center

4.0009, GROWTH AND CHARACTERIZATION OF EPITAXIAL PIEZOELECTRIC SEMICONDUCTOR FILMS

K.M. Lakin, University of Southern California, School of Engineering, Dept. of Electrical Engineering, *3551 University Ave., Los Angeles, California* 90007 (DF047570; F49620-79-C-0138)

AF function - microwave signal processing devices are essential components of Air Force communications, reconnaissance, and electronic countermeasures systems. Opportunity - microwave signal processing devices can utilize surface acoustic waves (SAWs) to perform functions such as filtering, encoding and decoding, signal delay, and signal correlation or convolution. Optimum performance of these functions is limited by the material used to support the SAWs, and improvements can be expected when materials having more appropriate SAW properties are utilized. Objective - this research will investigate new structures for supporting surface acoustic waves. How work contributes - the effort will advance surface acoustic wave devices for microwave signal processing.

Optimum conditions will be determined for the deposition of high quality single crystal aluminum nitride films on sapphire substrates. An alternative to this structure is zinc oxide films on nonpiezoelectric substrates; therefore, the reaction kinetics and flow dynamics involved in ZnO film preparation by the reaction of water and diethyl zinc will be studied. Hydrothermal growth will be investigated to determine what improvements might be realized in the growing of piezoelectric thin films over the techniques of chemical vapor deposition, liquid phase epitaxy, and molecular beam epitaxy.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0010, DESIGN AND PROTOTYPE FABRICATION OF A CURRENT-TECHNOLOGY FLYWHEEL-ELECTRIC VEHICLE

R. Schwein, U.S. Dept. of Defense, Air Force, Air Force Academy, Electrical Engineering Dept., *Colorado Springs, Colorado* 80840 (DF282230)

AF function - technology base with near-term benefit to mission support. Deficiency - motor pool cost for short-range transportation of small numbers of personnel is high due to the high cost of gasoline and the inefficiency of gasoline engines. Current electric vehicles with lead-acid batteries suffer from short range. Objective - this research is to demonstrate the feasibility of a flywheel-electric car with adequate range using current technology and lead-acid batteries. How work contributes - such a vehicle could save some of the cost of motor pool operations and could provide a test bed for more advanced batteries.

A 4-passenger car will be constructed on an existing frame with a lightweight body. High efficiency will be approached by use of a flywheel-motor subsystem driving the wheels through a continuously variable transmission. Power storage will be in a conventional lead-acid battery array. The transmission will be shifted automatically for efficiency and ease of driving. The baseline data from the vehicle using lead-acid batteries will be used to evaluate present potential for the concept and will provide a basis for comparison if high-technology batteries become available in the next few years.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Frank J. Seiler Research Lab.

4.0011, PLASMA WAVE TURBULENCE AND PARTICLE HEATING CAUSED BY ELECTRON BEAMS, RADIATION, AND PINCHES

M.V. Goldman, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Astro Geophysics, *1200 University Ave., Boulder, Colorado* 80302 (DF035410; AFOSR-80-0022)

AF function - operation of high altitude vehicles in a post-nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand fundamental understanding of the processes of plasma wave turbulence and heating by electron beams, radiation and pinches. Deficiency - the aforementioned information required to design advanced equipment is not available today. Its acquisition may be realized by both experimental and theoretical research. Objective - this project will investigate the fundamentals of Langmuir plasma turbulence excited by electron beams (and to a lesser extent, laser beams), including wave-particle interactions. It will provide theoretical support for experiments on the Culham plasma focus device to prove both laser-induced and current-driven plasma turbulence and also Prof. A. Wong's experiments at UCLA. It will also develop a theory of high beta pinches. Contribution - this work is part of a comprehensive program of plasma research for the development of an X-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beam), the development of space and ionospheric communications, and the development of countermeasures.

The general research topic will be plasma turbulence caused by electron beams and radiation with main emphasis on high beta pinches. A new experimental program will commence on 1) bunched ion beams accelerated by ion acoustic waves (driven either by a modulation electron beam or density modulation), and 2) heating and acceleration of ions by current-driven electrostatic ion cyclotron waves. In the area of radiation plasma interactions, Colorado will conclude their theoretical studies of the Raman-induced Kerr effect (RIKE) with particular emphasis on effects of spatial inhomogeneity, two applications will be explored -1) application to physical plasmas such as the ionosphere and laboratory plasmas in strong magnetic fields, and 2) diagnostic capabilities for CO2-driven Langmuir waves in the dense plasma focus experiments of N. Peacock, et al. Thermal self-focusing and other nonlinear collective effects of high power radar in the atmosphere will be studied at frequencies above 10 MHz. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0012. COMMUNICATIONS - PROPERTIES AND APPLICATIONS OF GaInAsP AND GaInAsP-InP HETEROJUNCTIONS

R.E. Hayes, University of Colorado, Boulder Campus, School of Engineering & Applied Science, Dept. of Electrical Engineering, *1200 University Ave., Boulder, Colorado* 80302 (DN475262; N00014-75-C-0472)

The Navy has applications for solid-state microwave sources in communications and electronic systems. Reduced size and power requirements of transferred electron devices (Gunn effect oscillators) are leading to the usage of these devices in many systems applications. This program will investigate the quaternary III-V compounds, GaInAsP and its heterojunction on InP, and determine its properties that are of importance for these devices.

The investigator will measure the velocity-field relation up to the transferred electron threshold on samples of GaXIn(1-X)AsYP(1-Y) for a number of compositions, and investigate the properties of anodic oxides and interfaces over the composition range.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0013, NOVEL LASER RESONATORS

P. Mumola, Perkin Elmer Corp., *Main Ave., Norwalk, Connecticut* 06852 (DN980326; N00173-78-C-0473)

To develop new resonator concepts for high power cylindrical chemical lasers.

To achieve single high order azimuthal mode operation by means of struts and to correct for phase steps at the output by means of 1/4 wave reflective phase plates.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0014, DIFFERENTIAL PRESSURE TRANSDUCER DEVELOPMENT

J. Lennon, United Technologies Corp., Hamilton Standard Division, *Bradley Field Rd., Windsor Locks, Connecticut* 06096 (DN889786; N00140-78-C-0073)

The principal objective of this effort is to develop and demonstrate a high-accuracy differential pressure transducer, designed to sense the fan discharge Mach number in an advanced military aircraft gas turbine engine, and to be used in conjunction with advanced digital electronic fuel controls. The accuracy goal is 1% of point over a range of 0.25 to 25.0 psi differential at absolute pressure levels of 2 to 100 psia. The reliability goal is 100,000 hours Mean Time between Failures. The response goal is a system time constant less than 20 milliseconds.

This effort will design, fabricate, and test a miniaturized vibrating cylinder pressure transducer. Design optimization for size will be followed by two hardware iterations with breadboard testing. The finalized sensor will undergo performance and environmental testing followed by delivery of two units to NAPC.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

4.0015, MOLECULAR BEAMS FROM FREE JET SOURCES

J.B. Fenn, Yale University, School of Engineering, Dept. of Engineering & Applied Science, *206 Elm, New Haven, Connecticut* 06520 (ENG79-10843)

The research deals with molecular beam methods for the study of kinetic processes. The beams are formed by supersonic free jets obtained by expanding high pressure source gas into vacuum from small sonic nozzles. There are three studies: 1. Liquid Surface Studies -molecular beams are scattered from liquid surfaces which are maintained in a clean condition by a continuous wiping technique. The angular distribution of reflected molecules is determined at various angles and velocities of incidence. 2. Reactive Scattering from Surfaces - the probability of reaction for molecules incident on surfaces is determined by means of a recycling molecular beam reactor. The study is focused on isomerization and cracking reactions. 3. Shock Tube Beam Source -research continues on the use of small-bore shock tubes as pulsed molecular beam sources. Capacitance discharges have been used as sources of driver energy. Laser pulses are to be used. Appropriate diagnostic techniques are developed.

The research is a continuation of that done under NSF Grant ENG7521821. The funding is for the first year of a three-year grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0016, ELECTRICALLY EXCITED LASERS

L.F. Champagne, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN620092)

The Department of Defense has need for efficient, compact laser sources for applications such as communications, ranging, detection and navigation. Electrical excitation is projected to preferentially populate excited states in atoms and molecules and hence to provide the population inversions necessary for laser development.

Electron-beam, electron-beam sustained and other electric-discharge techniques are being investigated for CW and pulsed laser source development. The physics of electron and ion collisions are studied to understand the underlying atomic and molecular excitation processes. The use of gas-dynamic techniques to create or increase population inversions is studied.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0017, ANALYSIS OF REMOTELY SENSED SIGNATURES

I. Jurkevich, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680432)

To develop mathematical techniques for extraction of naval surveillance information from medium to high resolution space-acquired imagery to implement such techniques in an interactive man-machine instrument complex, and to permit fast, nearly optimum interpretation of image material. Scene characterization signatures, atmosphere degradations, sensor transfer functions, display transfer functions, and the human visual system are considered as elements affecting the information extraction function.

Methods of image coding, point-to-point transformation, pattern analysis, spatial domain analysis for variant point-spread functions, etc., in their digital formulation will be applied to typical imagery to test their applicability to naval surveillance of both the environmental and military scene. Certain aspects of image processing lead to nonlinear mathematical formulations which remain unexplored. Practical implementation of even the simpler linear problems has been sketchy and the limits to which they can be extended are unknown.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0018, OPTICAL DIAGNOSTICS

J.R. McDonald, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880005)

Program objectives are (1) to develop and apply optical and laser techniques to characterize combustion sources and combustion chemistry; (2) to develop new techniques for analyzing low level constituents in contaminated atmospheres, such as in handling and processing of nuclear fuels; and (3) application of new lasers and techniques for use in characterizing gas and solution phase photochemical processes.

Tunable lasers and classical radiation sources are used to develop optical probing techniques. These laser diagnostic techniques are combined with state-of-the-art data, acquisition and processing techniques to develop automated optical diagnostics.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0019, MECHANISMS OF DESENSITIZATION (CO-OP)

J.M. Schnur, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680047)

Identify the important ultrafast reactions in energetic materials. Determine the role of free radicals in contributing to the sensitivity of initiation of existing high energy propellants and explosives.

Conduct photochemical experiments utilizing the unique capabilities of the picosecond laser facilities in the Optical Sciences Division at NRL. Perform picosecond time-resolved absorption and fluorescence spectroscopy of photo-initiated ultrafast reactions in energetic materials. Investigate the effects of various stresses and additives upon the early-stage kinetics of these molecular systems.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0020, INTERACTION AMONG INHOMOGENEITIES 14127-E

T. Mura, Northwestern University, Evanston Campus, Technological Inst., Dept. of Civil Engineering, *633 Clark St., Evanston, Illinois* 60201 (DA0E9287; DAAG29 77 G0042)

To study the elastic interactions among inhomogeneities under applied loads and to apply the results to constitutive equations and fracture mechanics. Improvements in fracture mechanics could provide results applicable to helicopter structure design. This method may provide a new approach to cracks under mixed modes and crack branching in composite materials.

A theoretical solution for two ellipsoidal inhomogeneities in an infinite medium under a linear applied stress at infinity will be the starting point. This will be generalized to the case where many ellipsoidal inhomogeneities are present.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0021, HIGH FIELD TRANSPORT OF FREE CARRIERS AT THE Si-SiO2 INTERFACE 17687-A-EL

K. Hess, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *106 Engineering Hall, Urbana, Illinois* 61801 (DA0G3444; DAAG29-80-K-0069)

To study theoretically important transport parameters of inversion layer electrons (holes). Relevance - the research is closely relevant to ETDL's mission on high priority semiconductor interfaces, VHSIC and USER.

Specifically, the validity of the deformation potential theorem will be investigated, the effect of remote and electro-negative scattering centers and the emission and diffusion of hot electrons will be studied.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0022, NAVY VEHICLE DESIGN AND CONSTRUCTION - DESIGN TECHNIQUES FOR MULTIVARIABLE DIGITAL CONTROL SYSTEMS WITH MULTIPLE SAMPLE RATES

D.P. Glasson, Analytic Sciences Corp., *6 Jacob Way, Reading, Massachusetts* 01867 (DN975440; N00014-79-C-0431)

During the design of a digital flight control system, it can be advantageous to have different feedback loops sampled at separate rates in order to save on computer requirements. For example, the response characteristics of an inner stability loop and an outer guidance loop are usually an order of magnitude apart and, therefore, the sample rates of each loop can also differ by the same amount. No modern control theoretic technique exists for designing multivariable digital control systems with multiple sample rates. The purpose of this project is to develop practical synthesis and analysis methods for multirate digital control systems.

For this second year's effort, a methodology will be developed to determine the optimal set of sample rates for a multirate control system. Optimality will be determined by optimizing system performance under a computational constraint. The contribution of the research will be an analytical procedure for sample rate selection which does not rely on engineering judgment. An optimal multirate control structure will be designed for a fighter aircraft dynamic model to test the sample rate optimization formulation. Variations of system performance and robustness as a function of computational burden will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0023, OPERATOR CONTROL PERFORMANCE - THEORY AND MODELS OF SUPERVISORY CONTROL FOR TELEOPERATOR AND VEHICLE SYSTEMS

T.B. Sheridan, Massachusetts Inst. of Technology, School of Engineering, Dept. of Mechanical Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DN775320; N00014-77-C-0256)

This research investigates operator control performance with Navy teleoperator and vehicle systems employing advanced interactive control methods. The technical goal is to derive models of operator performance and to determine the environmental, task and control/display factors that most significantly mediate effective control performance.

Theories and normative models are formulated to examine the dynamics of operator-computer collaboration in trading and sharing system control functions. Selection of environmental, task and control/display variables for this phase of work derives from an analysis of undersea teleoperator and vehicle systems and operations. Relevant sensor communications and computer technologies affecting allocation of control and transfer of information are examined. Laboratory and field experiments are conducted to investigate the effects of control modes and display methods upon operator performance and workload.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0024, ELECTROMAGNETIC SCATTERING

T.B. Senior, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Electrical Engineering, *Ann Arbor, Michigan* 48104 (DF047000; AFOSR-77-3188)

AF function - radar scattering cross-section reduction for aerospace vehicles. Opportunity - radar absorbing surface coatings reduce cross-section. Objective - to reduce not only specular but also nonspecular or diffracted contributions to scattering cross-section. How work contributes - by examining the effect that surface coating impedance has on travelling, creeping, and edge waves, edge reflections, etc.

The reduction of radar backscattering from wings and fins will be explored by generalizing Malinzhinet's method to solution of the resistive half-plane problem and possibly a resistive-sheet wedge. An integral equation for rectangular non-uniformly resistive plates will be formulated and, using a computer solution, the effects of selected resistivity variations on backscattering cross-section will be studied. Alternate formulations applicable to larger area plates will be sought.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0025, AERODYNAMIC STALL ALLEVIATION FOR SWEPT-WING PLANFORMS

R. Vangunst, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Aerospace Engineering, *Ann Arbor, Michigan* 48104 (DN078815; N00167-80-C-0058)

To experimentally investigate the applicability of straight-wing stall alleviation technology by leading edge modification to a swept-wing planform. This contract is in support of DTNSRDC work unit 1606-300, reported under DN 678328.

The leading edge modification technique for increasing lift beyond stall angles of attack has been previously demonstrated in case of straight wings. In the present work, the contour of the leading edge modification will be optimized. Existing straight-wing models at the University of Michigan will be used. The optimum configuration will be applied to swept-wing planforms with sweep angles of 30 and 45 degrees. This will be accomplished by replacing a rectangular section from the leading edge of the wing with an insert having the optimized planform characteristics. The swept-wing insert configuration parameters will be varied to identify areas of improvement for the swept-wing planform. This study will examine the sensitivity of each major planform feature and span-wise location for its effect on the lift, drag, and pitching moment characteristics of the model. All configuration and span-wise location changes which enhance the lift and angle-of-attack characteristics of the wing will be incorporated into a final configuration. Upon completion of the program, all test results will be presented and summarized in a final report.

SUPPORTED BY U.S. Dept. of Defense, Navy, David W. Taylor Naval Ship Research & Development Center

4.0026, UNSTEADY TRANSONIC FLOWS IN A TWO-DIMENSIONAL DIFFUSER

M. Sajben, McDonnell Douglas Corp., *P.O. Box 516, St. Louis, Missouri* 63166 (DF048360; F49620-77-C-0082)

AF function - advanced aerospace vehicles. Opportunity - increase our fundamental knowledge of the parameters which cause dynamic inlet distortion. Objective - the first objective will be to explore experimentally the effects of approach boundary layer properties on the unsteady behavior of two-dimensional, transonic diffuser flow. Upon completion of this, the response of diffuser flows to unsteady perturbations introduced downstream of the diffuser will be experimentally explored. How work contributes - understanding of the mechanisms responsible for the flow unsteadiness will provide the basis for establishing scale laws and developing inlet-compressor matching methods that are based on fundamental principles of fluid mechanics.

Appropriate hardware will be designed and built to permit varying the thickness of the boundary layer approaching the inlet throat. A matrix of test parameters will be established adequate to cover all significant fluctuation modes. Oil flow traces and high speed schlieren movies will be used as visualization

techniques. All data will be analyzed and correlated. Upon completion of this phase hardware will be designed and built which will permit the introduction of external, nearly sinusoidal perturbations at the diffuser exit. A new matrix of test parameters will be established to cover a range of realistic perturbation amplitudes and frequencies and pressure ratios. Data will be collected, analyzed and documented in a form suitable for comparison with theoretical prediction methods.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0027, RESEARCH ON UNSTEADY COMBUSTION PROCESSES

D.B. Bliss, Princeton University, School of Engineering & Applied Sciences, Dept. of Mechanical & Aerospace Engineering, *Box 430, Princeton, New Jersey* 08540 (DF045780; AFOSR-76-3104)

AF function - most advanced Air Force strategic and tactical rocket weapons rely on solid propellants for propulsion. Deficiency - more energetic and reliable propellants are required for future weapons. Objective - this research is aimed at increasing the understanding of the unsteady combustion process which occurs in solid propellants, especially in the areas of velocity-coupled instabilities and the burning of aluminum droplets. How work contributes - the understanding gained will permit the design of more reliable high performance missiles.

Efforts will continue to develop the modulated throat rocket motor (MTRM) concept for the measurement of the response functions of solid rocket propellants. Methods to measure the unsteady velocity characteristics at the MTRM nozzle will be examined for use with present methods to measure unsteady pressure components. A linearized analysis will be developed for the MTRM data that will permit measurement of both velocity- and pressure-coupled response characteristics. The use of laser velocimetry and fluid-conductor magnetic flow-rate transducers will be examined for performing simultaneous measurement of unsteady pressure and velocity fluctuation in the MTRM. Such will provide a direct measurement of the overall motor acoustic admittance. A solid propellant slab motor will be used to measure the erosive burning characteristics of two of the propellants used in the MTRM experiments, and the resulting data will be used to interpret the MTRM responses.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0028, NAVY VEHICLE DESIGN AND CONSTRUCTION - MICROPROCESSOR DIGITAL FLIGHT CONTROL INVESTIGATION

R.F. Stengel, Princeton University, School of Engineering & Applied Sciences, Dept. of Mechanical & Aerospace Engineering, *Box 430, Princeton, New Jersey* 08540 (DN975352; N00014-78-C-0257)

Future Navy aircraft will utilize digital logic to perform the complex flight control functions demanded by their severe mission objectives. Cost factors may dictate microprocessor implementation of these digital control laws. While hardware cost may ultimately reach low levels, the development costs associated with microprocessor technology will not be trivial. This investigation is directed towards developing new methodologies required for the design, analysis, and flight evaluation of advanced low-cost digital flight control systems.

During this third year's effort, three input/three output longitudinal and lateral-directional direct-force command modes will be designed using optimal control theory and implemented using microprocessor technology. Steady-state decoupling of command responses as well as satisfactory transient responses will be provided. Various strategies of redundancy management for multiple processors will be examined which would provide fault-tolerant architectures. Distributed processing and fiber-optic networks will also be investigated. A variable stability Navion aircraft will be flown for 20 hours to conduct these tasks.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0029, DEVELOPMENT OF FUTURE AIR DYNAMOMETER SYSTEMS

W.R. Foor, U.S. Dept. of Defense, Navy, Naval Air Engineering Center, *Lakehurst, New Jersey* 08733 (DN696015; N68335-75-C-2098)

Develop the technology required for a family of air dynamometer systems capable of testing current and future generation turboshaft engines.

Conduct analytical studies to establish design parameters for a family of air dynamometers. A feasibility demonstrator sized for the T-58/T700 engine will be designed, fabricated and tested. The analytical model will be updated to reflect the experimental data.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0030, AIRBORNE LASER PROPAGATION

B. Contreras, U.S. Dept. of Defense, Air Force, Weapons Lab., *Kirtland Air Force Base, Albuquerque, New Mexico* 87117 (DF169570)

To evaluate the effects of the aerodynamic environment on laser beam propagation. These effects include absorption and scattering by aerosols, boundary layer and atmospheric turbulence, flow field perturbations and shockwave interactions.

Wind tunnel model testing will be compared with flight test and theoretical predictions of optical degradations due to boundary layer turbulence, flow field and shock effects. Optical measurements will also be made on free air atmospheric turbulence in conjunction with balloon-borne and aircraft-mounted micro-thermal probes, and compared with meteorological data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

4.0031, AN AIR-VAPOR-DROPLET LOCAL INTERACTION MODEL FOR SPRAY UNITS AND SPRAY SYSTEMS

L.M. Jiji, City University of New York, City College, School of Engineering, Dept. of Mechanical Engineering, *Convent Ave. & 138th St., New York, New York* 10031 (ENG78-20709)

A comprehensive theoretical program is developed for predicting the performance of spray units, modules and systems which eliminates many of the important shortcomings of existing theories. The analysis of the individual spray units is based on a new interaction theory which is capable of describing the local variation in properties of both the air-vapor and droplet phases throughout the entire flow field. This basic model includes the effects of buoyancy, stable and unstable meteorological conditions and turbulent mixing in the atmospheric surface layer and does not require the use of design-dependent empirical factors. This unique feature permits the theory to be used for optimization design analysis for maximum performance of spray units, spray modules and overall spray system configuration. The general theoretical approach has broad application to many open and closed air-vapor-droplet flow systems such as cooling towers and combustion chambers.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0032, INVESTIGATION OF MOLECULAR BEAM EPITAXIAL GROWTH OF COMPOUND SEMICONDUCTORS AND CONTACTS 15479-EL

L.F. Eastman, Cornell University, Ithaca Campus, School of Engineering, Dept. of Electrical Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (DA0G8960; DAAG29-80-C-0069)

To advance the state of the art in compound semiconductor layers, Schottky barriers and ohmic contacts for electron devices. Relevance -this research will directly support an active program at ERADCOM/ETDL to improve materials technology for very high speed integrated circuits. Close cooperation between this principal investigator and ETDL has already been established.

To use molecular beam epitaxy (MBE) to grow bulk and layered structures. Characterize and analyze grown materials for

metallurgical and electrical properties in order to improve quality needed for device application.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0033, CONFORMAL ARRAYS AND HEMISPHERICAL COVERAGE ARRAYS

J. McIlvenna, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF903720)

To develop lightweight, inexpensive, flush-mounted and conformal antenna elements and arrays for aerospace use. Designs are specialized to offer enhanced scanning coverage over the full hemisphere.

To design and test elements and arrays in microstrip that provide increased pattern performance in the end-fire directions. To utilize new array geometries, such as the tent redome concept, in low drag designs, for airborne communication links.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0034, THERMAL CONDUCTIVITY OF TERNARY AND QUATERNARY III-V COMPOUNDS 16936-EL

W.J. Collis, University of North Carolina, North Carolina Agricultural & Technical State University, School of Engineering, Dept. of Mechanical Engineering, *N. Dudley St., Greensboro, North Carolina* 27411 (DA0G2735; DAAG29-80-C-0088)

Experimental studies will be conducted to determine the thermal conductivity of GaAlAs, GaInAs, and GaInAsP thin layers grown upon GaAs and InP substrates by liquid phase epitaxy. Relevance - knowledge of the thermal conductivity in these materials is very important for devices such as photovoltaic cells, injection solid-state lasers, and high frequency, high power FET, GUNN and other transfer electron devices in which thermally related degradation and removal of the generated heat are major problems.

Experiments will be conducted to determine the functional dependence of the thermal conductivity on alloy mole fraction, temperature, layer thickness and impurity concentration. The technique uses thin layers grown upon semi-insulating GaAs and InP substrates. Information obtained, along with the macroscopic heat diffusion equation, will be used to compute the thermal conductivity.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0035, ANALYTICAL TECHNIQUES FOR DETERMINING NEAR FIELD ANTENNA CHARACTERISTICS

W.D. Burnside, Ohio State University, Columbus Campus, School of Engineering, Dept. of Electrical Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (DN890245; N00019-C-80-C-0050)

To develop an analytical technique for determining near field antenna patterns for communication antennas mounted on an aircraft body. A knowledge of the near field characteristics would significantly improve the present state-of-the-art in designing aircraft antennas, both from the standpoint of performance and expense because the characteristics could be determined more accurately without expensive modeling.

The near field antenna problem will be initially separated into two parts, a finite flat plate and an elliptic cylinder. Geometric theory of diffraction techniques will be used to determine the Green's functions for such finite shapes. These results will then be combined such that the near field solutions for an elliptic cylinder with attached flat plates can be obtained.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0036, DYNAMICS OF STRUCTURAL CHAIN SYSTEMS

R.L. Huston, University of Cincinnati, School of Engineering, Dept. of Engineering Analysis, *101 Baldwin Hall, Cincinnati, Ohio* 45221 (DN323083; N00014-76-C-0139)

The technical objective of the proposed work is to research and develop a systematic, computer-oriented method for obtaining and solving equations of motion of general chain structural systems of naval interest such as cables, chains, antennas, long flexible booms and aircraft-occupant dynamics. The dynamic equations of motion for such systems are highly nonlinear due to the large geometric effects and the structural interactions.

The basic approach is to model mechanical systems (e.g., human-body models, cables, beams, head/neck muscles and vertebrae, antennas, etc.) by a series of rigid bodies connected by springs and/or dampers and/or ball-and-socket joints. Dynamical equations of motion are then written for such systems using basic principles of dynamics (Lagrange's form of d'Alembert's principle). Computer algorithms are written to generate the coefficients of the governing dynamical equations of motion (coupled, quasi-linear, second-order nonlinear, ordinary differential equations).

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0037, LOWER D-REGION/UPPER ATMOSPHERE WATER VAPOR MEASUREMENTS

L.C. Hale, Pennsylvania State University, University Park Campus, Ionosphere Research Lab., *201 Shields Bldg., University Park, Pennsylvania* 16802 (DN975545; N00014-79-C-0610)

Upper atmospheric and lower d-region ionospheric composition are not well-known even though they have a large influence on radio communications and radar from VLF to UHF. The state of water in that region of the atmosphere is critical to understanding and exploiting the propagation medium to the Navy's best advantage.

Microwave radiometer measurements of the upper atmosphere water vapor and related phenomena will be carried out in conjunction with in situ rocket probe measurements from the NASA Wallps Island, VA facility. Existing models will be checked against the data and new models constructed where necessary.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0038, DONOR-TYPE GRAPHITE INTERCALATION COMPOUNDS 14625-P

J.E. Fischer, University of Pennsylvania, School of Engineering & Applied Sciences, Dept. of Electrical Engineering, *4001 Spruce, Philadelphia, Pennsylvania* 19104 (DA0F9050; DAAG29 77 C 0040)

To determine the basic electrical conduction mechanisms of graphite intercalation compounds. Relevance - intercalated graphite compounds have been shown to exhibit unusually high electrical conductivities in the basal plane, approaching that of copper. This coupled with lighter weight make these compounds interesting systems with potential for revolutionary impact in power generation and motors.

Electronic transport will be studied by conductivity, Hall coefficient, magnetoresistance, and metallic reflectance measurements from 4.2-300 K. Graphite will be intercalated with electron donor species including Li, K, Rb, C2 (monovalent), and Ba (divalent) and studied for several stoichiometric concentrations corresponding to varying C-axis superlattice periodicity.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0039, ANALYTIC DESCRIPTION OF THE GROWTH AND DECAY OF GRAVITY WAVES

J.T. Liu, Brown University, Graduate School, Dept. of Engineering, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DN223187; N00014-76-C-0363)

The duration and length scale of turbulent fluid dynamics disturbances in the atmosphere and ocean are critical factors in

naval missions. For example, both the discrimination of submarine-induced turbulence and the detection of atmospheric clear air turbulence are related to the persistence of shear flow instabilities in stratified fluid media.

The generation and breaking of gravity waves induced in a shear flow of a stratified fluid are only vaguely understood because the processes involve nonlinear interactions of turbulence scales with the organized motion of the fluid. Thus far no comprehensive analytic description of the genesis and history of the phenomena has been successful. This task proposes a numerical model to achieve this end.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0040, TURBULENT MIXING RESEARCH
P.T. Harsha, Arnold Research Org. Inc., *Arnold Air Force Base, Tullahoma, Tennessee* 37389 (DF420818; F40600-74-C-0001)

Aerospace weapon delivery systems involve turbulent mixing processes with and without simultaneous chemical reactions. These turbulent flow processes occur in the combustors of aircraft, advanced ramjets and air-augmented rockets in turbojet and rocket exhaust plumes, and in chemical lasers. Included in the objectives of this research are (1) development of reliable and physically perceptive models for turbulent mixing processes, and (2) development of reaction chemistry models applicable to turbulent combustion processes. The resulting analytical models will contribute to the design of combustors and to the solution of other system problems.

Special emphasis is placed on mixing systems which are used in propulsion devices and ground testing facilities.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Arnold Engineering Development Center

4.0041, THERMODYNAMICS AND KINETICS OF INTERSTITIAL SOLID SOLUTIONS 16089-MS
R.B. McLellan, Rice University, Graduate School, Dept. of Mechanical & Aerospace Engineering, *6100 Main St., Houston, Texas* 77001 (DA0G9084; DAAG29-79-C-0108)

To study the thermodynamics and kinetics of hydrogen dissolved interstitially in metal solid solutions, in order to obtain realistic thermodynamic models of such alloys. Relevance - the research is relevant to the synthesis and processing and subsequent properties of many metal alloys in current use in weapon components, ammunition, mobility and construction applications, and in the degradation of high strength steel and aluminum alloys used in aircraft and tank structures by hydrogen embrittlement.

Thermodynamic and kinetic measurements on a series of binary and ternary solid solutions containing dissolved hydrogen as a function of temperature and pressure to determine the nature of atomic interactions responsible for the quantities measured. Thermodynamic and kinetic measurements to determine deviations from ideality of the solubility of interstitials due to trapping sites and impurity atoms. Modelling of lattice occupancy sites by interstitials as a function of basic thermodynamic and kinetic parameters ranging from metallic solid solutions having low solubility (alloys of iron, aluminum, nickel) to those for which solubility is very high (body-centered cubic modifications of Nb, V, and Ta).

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0042, POSITRON ANNIHILATION STUDIES OF DEFECTS IN SOLIDS
J.G. Byrne, Utah Higher Education System, University of Utah, School of Engineering, Dept. of Mechanical Engineering, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DF040820; AFOSR-75-2810)

AF function - nondestructive evaluation (NDE) of materials before and during service saves the Air Force many lives and millions of dollars annually. Structural (airframe) and high performance (turbine engine) materials must be inspected periodically and evaluated to determine their continued use or need for replacement. Deficiency - many critical defects such as metal fatigue and small cracks are impossible to evaluate with current NDE techniques. Objective - this research seeks to develop a new technique, positron annihilation, to inspect small internal defects in metals. How work contributes - early detection of fatigue and other types of damage in operational structures is essential for their continued reliable, safe operation.

Positron annihilation techniques will be used to study pure aluminum and alloys of Al-Cu, Al-Zn, Al-Li, 7075 and 2024. Aging and deformation conditions will be studied to assess the utility of this method for nondestructively evaluating the structural properties of aluminum alloys.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0043, AIRBORNE ELECTROOPTICAL SENSOR PERFORMANCE MODELING (DA0N8079)
R.D. Leighty, U.S. Dept. of Defense, Army, Corps of Engineers, Engineer Topographic Lab., *Fort Belvoir, Virginia* 22060 (DA0G0251)

Preliminary study of airborne electrooptical sensor performance models for reference scene synthesis.

Existing electrooptical sensor performance models were surveyed for potential value to future reference scene synthesis studies. A set of models associated with the FLIR sensors was selected for detailed review for generating synthetic scenes of the real world.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Engineer Topographic Lab.

4.0044, OPTIMIZATION OF MULTI-ELEMENT AIRFOILS
J. Sandford, Von Karman Inst. for Fluid Dynamics, *Rhode St. Genese, Belgium* (DF702800; AFOSR-80-0177)

AF function - research in subsonic aerodynamics/high lift devices. Deficiency - current design techniques for multi-element high lift devices require a great deal of costly testing to optimize the configuration. A reliable methodology which would optimize the configuration in the design state is required. Research - the geometry of a four-element configuration will be specified but its relative disposition will be variable. An optimization technique will be used to determine as rapidly as possible the maximum lift configuration. How research contributes - previous investigations are applicable only to two-dimensional flows. The proposed research will include viscous effects, including those associated with confluent boundary layers.

Methods are available for the prediction of the characteristics of multi-element airfoils. The intention here is to apply such methods to a configuration formed from specified elements and to apply optimization theory to the spacing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, European Office of Aerospace Research & Development

4.0045, STUDY OF METAL VAPOR PLASMAS CREATED BY LASER ABLATION
R.M. Measures, University of Toronto, *Medical Sciences Bldg., Toronto, Ontario, Canada* M5S 1A8 (DF041850; AFOSR-80-0057)

AF function - operation of high altitude vehicles in a post-nuclear explosion environment. Development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand new types of highly efficient and effective lasers. Such lasers are metal vapor lasers. Deficiency - little information is available today in understanding the fundamental processes of operation of metal vapor lasers. Its acquisition may be realized by a well-planned theoretical and experimental research. Objective - this project will investigate both theoretically and experimentally laser-ablated metal vapor plasmas, using selective laser excitation spectroscopy to study the dependence of the degree of excitation of the metal vapor plasma upon the wavelength and pulse duration of the ablation laser. Contribution - this work is part of a comprehensive program of plasma research for the development of an X-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and parti-

cle beams), the development of space and ionospheric communications, and the development of countermeasures.

Radiation lifetime measurements of ionic transitions will be conducted on strontium samples in the newly retooled laser ablation apparatus. In addition, experiments will be conducted with the new sodium vapor-heated quartz cell to look for filamentation due to self-focussing. Further improvements will also be made on the LIBORS (laser interaction-based resonance saturation) computer simulation code in order to take additional physical effects into account.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0046, LOW FREQUENCY POLAR REFLECTIVITY
N.V. Jensen, Danske Meteorologiske Institut, *Lyngby, Denmark* (DF904350; AFOSR-78-3545)

AF function - navigation and survivable communications. Deficiency - communication interference from natural and nuclear ionospheric disturbances. Objective - employ high resolution techniques to measure Arctic propagation stability under normal and disturbed ionospheric conditions. How research contributes - provides the experimental information required for interpreting and modeling VLF/LF propagation.

The propagation reliability of these frequencies is based on theoretical modeling for which there is only limited quantitative data, particularly for disturbed conditions. As the lower ionosphere is severely disturbed during polar cap absorption events which occur occasionally at high latitudes, a unique opportunity is provided to investigate propagation effects. To observe this phenomenon, AFGL's VLF/LF ionosounder was moved to Greenland with the transmitter at Thule Air Base and the receiver at the Danish Meteorological Institute's ionospheric observatory in Qanaq, Greenland. Through this research grant the receiver will be installed and operated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, GALILEO-NIMS
H. Masursky, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Astrogeological Studies, *2255 N. Gemini Dr., Flagstaff, Arizona* 86001 (0-9580-02236)

Operations plans for the Galileo mission, now scheduled for a 1984 launch and 1986 encounter with Jupiter and its satellites, are progressing; a first draft of the mission operations plan and a final report listing the science requirements for the mission have been completed. Plans for developing a high spatial and spectral resolution planetary camera/spectrometer, utilizing solid-state detectors, were initiated in 1979 and will be finalized in 1980. Design for the satellite tour and for specific imaging sequences will continue during 1980.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0002, SEVERE VORTICAL STORMS
F.E. Fendell, Thompson Ramo Wooldridge Inc., Defense & Space Systems Group, *1 Space Park, Redondo Beach, California* 90278 (DN975546; N00014-79-C-0508)

The objective of this research is to address the threat to Navy facilities, ships, aircraft and manpower posed by the exceptionally severe hurricane/typhoon. Interference with naval missions, and even serious wartime losses because of deep-pressure depressions over tropical oceans are a matter of historical record. Thus, the ultimate goal of this research is to establish an observable access to meteorological satellites, overflying aircraft, etc., that would permit one to anticipate the rapid further intensification of an already well-organized tropical storm.

In this stage of the research the contractor continues delineation of the evolution of a moderately intense one-cell vortex to a very intense two-cell vortex. He is completing the description of the two-cell vortex. In particular, the properties and location of the eye wall are being sought.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0003, GALILEO SOLID-STATE IMAGING
M.H. Carr, U.S. Dept. of the Interior, Geological Survey, Geologic Div., Branch of Astrogeologic Studies, *345 Middlefield Rd., Menlo Park, California* 94025 (9580-02239)

The Galileo Mission is a combined orbiter/probe spacecraft mission to explore Jupiter and the Galilean Satellite. In FY 1980 the goal of the Galileo Solid-State Imaging Project is to continue defining the Galileo camera performance and overall mission design in response to the Voyager results and slippage of the NASA Shuttle.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0004, GRAM SOURCE MECHANISM STUDIES
F.G. Fischer, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *345 Middlefield Rd., Menlo Park, California* 94025 (0-9930-02100)

STATE TO WHICH PROJECT PERTAINS: California.

Several questions of current interest to U.S. and Soviet investigators involved in joint studies for earthquake prediction involve properties related to the source mechanisms of local earthquakes. This project will collect sufficient data and perform the analysis necessary to answer the following questions: 1. How variable is the seismic source spectrum from station to station? 2. What are the important propagation effects and how can they be corrected for in analyzing the source spectrum? 3. After corrections are made for effects of propagation and near-station effects, do the estimates of the source spectrum at each station show a dependence on azimuth and take-off angle relative to the focal mechanism? 4. What is the limit of resolution in estimating seismic moment and stress drop using local earthquake data? 5. Do the parameters of the seismic source vary systematically in space and time within a relatively small region?

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0005, PHYSICAL PROPERTIES OF THE VIKING LANDING SITES
H.J. Moore, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *345 Middlefield Rd., Menlo Park, California* 94025 (0-9580-02374)

The objectives of this project are: (1) to analyze data relevant to the physical properties of surface materials at the Viking landing sites, Mars, and (2) perform experiments in the laboratory using a surface sampler assembly in materials that simulate the Martian surface materials.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0006, NAVY ENVIRONMENT - SATELLITE APPLICATIONS AND MARITIME WEATHER SYSTEMS
T.H. Vonder Haar, Colorado State University, School of Engineering, Dept. of Atmospheric Sciences, *Fort Collins, Colorado* 80523 (DN975695; N00014-79-C-0793)

This proposal has four related objectives. There is work on maritime aerosols observations from satellites with some simultaneous multisensor (including surface) data interpretation. The second objective deals with cloud microphysics with emphasis on radiance. The third objective addresses pre-cloud (fog) air mass characteristics as observed by satellites. An overall objective is to advance the interactive use of satellite information and modeling of the marine atmosphere.

The contractor is using satellite data to analyze pre-cloud (fog) maritime aerosols. Interactive satellite information is being

exploited for observing the marine atmosphere to improve prediction of maritime weather systems.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0007, PROFS SPECIAL PROJECT (SATELLITE)
R. Alberty, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab., *Boulder, Colorado* 80302 (8AA78052)

PROJECT OBJECTIVE: Establish a meteorological satellite data ingest capability for PROFS Exploratory Development Facility (EDF).

CURRENT YEAR PLAN: Develop satellite data products and transmission of these products.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Lab.

5.0008, DEVELOPMENT OF HIGH-FREQUENCY ELECTROMAGNETIC TECHNIQUES
R.D. Watts, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *Box 25046, Denver Fed. Ctr. Bldg. 25, Denver, Colorado* 80225 (9780-01756)

STATES TO WHICH PROJECT PERTAINS: Utah, New Mexico.

Experimental and analytical studies of antennas immersed in fluid-filled boreholes will be carried out. Results of these studies will be necessary for interpretation of actual borehole measurements. Characterization of certain highly resistive geologic formations will be done in order to determine their radio propagation characteristics so optimum borehole systems can be designed. Analytical studies of antennas and of radio wave propagation will be done as an aid in interpreting experimental and field results.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0009, REMOTE SENSING SURVEYS FOR AGRICULTURAL STATISTICS
W.H. Wigton, U.S. Dept. of Agriculture, *12th & Independence Ave. S.W., Washington, District of Columbia* 20250 (0016918; RD-03)

OBJECTIVE: Develop techniques of automated data extraction and statistical methods for using remote sensing data recorded as photographs or multispectral imagery, with reference to field crops, fruit trees and livestock estimates.

APPROACH: Conduct experiments using ground photography, aircraft and satellite imagery in cooperation with universities. Automated classification programs will be developed to identify crop species and to assess crop damages. Automated discrimination programs will be developed to make fruit counts on citrus and deciduous tree crops. Ground truth will be obtained on a sample basis as needed to interpret and evaluate the results of sensor data. If remote sensing data are a feasible source of supplementary information, statistical methods will be developed for collection, interpretation and analysis.

PROGRESS: Research was conducted in two areas in 1976. The main thrust of our research and development was toward using near-real-time LANDSAT digital data to improve estimates of crop acreages. Such a use of LANDSAT in an operational mode would require receiving the LANDSAT digital data as quickly as possible after they have been obtained by the satellite (when the crops are mature enough to be distinguished from one another) and then classifying the 32,000 km of a LANDSAT scene. Statistical regression is used to adjust classified data for misclassification. 1975 LANDSAT data covering the state of Illinois were classified. Results were mixed. In some scenes, the precisions of crop-acreage estimates were improved by a factor of four. In other scenes (32,000 km) results were marginally beneficial. These differences were caused by dates of acquisition, atmosphere present, and distributions of land use within the scenes. Another use of LANDSAT products is being explored. This would involve using images to improve area frame stratification in the western U.S. For this purpose LANDSAT scales appear ideal. They cover enough area so that only a few scenes are needed to cover an entire state, and yet, sufficient detail is present for most stratification needs. Urban strata are exceptions, however.

SUPPORTED BY U.S. Dept. of Agriculture, Statistical Reporting Service, Crop & Livestock Estimating

5.0010, MARINE METEOROLOGY
S.G. Gathman, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880082)

Improve the operational capability of the Navy in its function of assessing the vulnerability of certain strategic and tactical systems produced by clouds, aerosols, water vapor, and turbulence throughout the marine boundary layer by establishing an oceanic climatology of these parameters through measurements and modeling.

Existing experimental measurements of EOMET parameters form both the open literature and various project reports, and unpublished cruise data are assembled and edited. These data are used as input parameters to the climatology and as test standards for verification of EOMET models. As these models evolve and are proven accurate, an all-season, world ocean climatology will emerge. In cases where the absence of marine data precludes the testing and acceptance of a model, ocean cruises and field experiments on marine representative sites such as S.N.I., involving all of the EOMET parameters, are undertaken.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Ocean Systems Center

5.0011, MARINE GEOCHEMISTRY/NAVAL APPLICATIONS
F.K. Lepple, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN020191)

To investigate the distribution of various chemical elements in the marine atmospheric boundary layer and in the upper ocean to relate marine aerosol composition to different sources, processes and meteorological events; to investigate dissolved trace element distributions with regard to ASW wake sensing. The Navy needs this background geochemistry of the ocean and atmosphere for remote sensing technology, operation of electrooptical devices, and protection of materials.

Water and air samples are collected aboard ships and aircraft. Principal analytical methods are instrumental neutron activation, X-ray fluorescence and atomic absorption spectroscopy. Equipment and methods are developed and evaluated for simultaneous, real-time monitoring of chemical species and related oceanic and atmospheric properties.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

5.0012, SURVEILLANCE - INVESTIGATION OF PROPERTIES OF RADAR BACKSCATTER FROM SEA ICE
R.K. Moore, University of Kansas, Lawrence Campus, Center for Research Inc., *122 Strong Hall, Lawrence, Kansas* 66045 (DN775037; N00014-76-C-1105)

The objective of this effort is to provide backscatter properties of sea ice to permit better interpretations to be made of the sea ice imagery taken during overflights of the Arctic with remote sensors; and to establish optimum parameters for future remote ice-measuring systems.

A transportable radar scatterometer has been assembled which is capable of variable frequency operation in the 12-18 GHz band and fixed frequency operation at 1.2 GHz. Using this equipment from a helicopter platform and varying the frequency polarization and angle of incidence, radar backscatter measurements of Arctic sea ice (first year ice, multi-year ice and pressure ridges under summer-early fall conditions) are to be made. These measurements are to be made as part of the Swedish YMER 80 exercise in the eastern Arctic. The results are to be analyzed and the optimum design parameters for radars to be

employed for remote sea ice monitoring from spacecraft or aircraft are to be generated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0013, EVALUATION OF NEW REMOTE SENSING INSTRUMENTATION OF AGRONOMIC CROPS
J.H. Elgin, U.S. Dept. of Agriculture, Agricultural Research, Plant Genetics & Germplasm Inst., Field Crops Lab., *Bldg. 001, Room 335, Beltsville, Maryland* 20705 (0044246; 1108-20100-003)

OBJECTIVE: Undertake cooperative research with NASA scientists in identifying optimum parameters for making equipment recommendations for satellites and space shuttle. Develop remote sensing and monitoring techniques on agronomic crops.

APPROACH: In consulation with NASA scientists, develop field cropping systems for remote sensing reflectance experiments. Detailed agronomic data will be collected for all cropping systems and correlations with NASA remotely sensed spectral measurements will be determined. Based on results of this research, recommendation for new remote sensing equipment will be made.

PROGRESS: All future progress of this research will be reported in CRIS Work Unit 1108-20760-001, which has just been initiated.

SUPPORTED BY U.S. Dept. of Agriculture, Agricultural Research, Beltsville Agricultural Research Center

5.0014, ULTRAVIOLET AIRGLOW PHOTOMETER
H.A. Miranda, Epsilon Lab. Inc., *Bedford, Massachusetts* 01730 (DF582090; F19628-79-C-0019)

AF function - trans-ionospheric ranging and communications, remote ionospheric monitoring. Deficiency - present state-of-the-art in relating natural optical emission to the electron density profile is not understood well enough to permit remote satellite monitoring of the auroral oval. Objective - in situ measurements with rockets of UV fluxes. How research contributes - provides direct measurements of atmospheric parameters to correlate with other measurements and computer codes being generated in the auroral E program.

Contractor shall design, fabricate and test an airglow photometer to measure the altitude profile of ultraviolet airglow emissions during flight on sounding rockets.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0015, SCATHA INSTRUMENTS
B.F. Sellers, Panametrics Inc., *221 Crescent St., Waltham, Massachusetts* 02154 (DF242880; F19628-74-C-0217)

AF function - communications and reconnaissance. Deficiency -unknown cause of erratic system performance. Research - develop instrument to measure electron and proton fluxes in .05-300 KeV energy range. How research contributes - this instrument will be used in the SCATHA satellite as one of a number of sensors intended to define the particle and field environment at synchronous orbit and its effect on satellite performance. It involves the design and testing of feasibility models and the fabrication of flight instruments and associated GSE. Instrument will feature maximization of information and minimization of weight, power requirements and telemetry demands.

The rapid-scan instruments designed for the SCATHA satellite must be shielded against energetic electrons. Appropriate electronic components are to be shielded as well as experimental testing of the detector response to background.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0016, MEASUREMENT OF THE NEAR-UV SOLAR FLUX
D.E. Bedo, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581270)

AF function - vehicle tracking during flight and reentry, trajectory prediction, interception, communications. Deficiency -insufficient data on solar irradiance levels to allow accurate modeling of the photochemistry and the compositional structure of the middle atmosphere and stratosphere and to allow prediction of the response of these regions of the atmosphere to temporal changes in the solar input. Objective - the determination of precise values for the absolute spectral irradiance for radiation emitted by the full solar disk at wavelengths between 1300 and 3500 Angstroms with a spectral resolution of 0.1 Angstrom. How research contributes - provides direct measurement of the major source of energy which is input to the earth's atmosphere at non-polar latitudes. Such information is required for the development of models involving atmospheric heating, photochemical reactions and charged particle production.

Solar irradiance data are acquired from rocket-borne instrumentation. Spectrometers of the Ebert type are mounted to biaxial solar-pointing controls which maintain the instrument axis on the solar vector with an accuracy of better than one arcminute. The spectrometer step-scans the spectral region of interest with at least four steps per resolution element and the step position and intensity data are continuously telemetered to the ground. Instrument recovery is routinely attempted but is not required for data return. Prior to flight all instrumentation is calibrated at AFGL using laboratory monochromators and photometric standards. Individual experiments include rocket flights of the UV spectrometer alone as well as joint flights involving both rocket and balloon instruments, the latter experiment providing differential measurements of the solar flux both above and below the stratospheric ozone layer.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0017, INSTRUMENTATION FOR SOLAR BURST DISK LOCATOR
D.N. Gaunt, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580850)

AF function - communications and surveillance. Deficiency - at present, burst disk location, an essential element of geophysical prediction, is obtained solely from optical observations, which are sometimes obscured by weather. Objective - to develop the techniques and instrumentation for determining burst disk position from interferometric observations. How research contributes - determination of burst disk position and motion will be helpful in understanding the phenomena and in predicting the travel path of solar energetic particles toward the earth.

Produce a data processing system which will generate a continuous, real-time (seconds) measurement of the position of a radioactive area from data presently available from an existing sweep frequency interferometer. The technique used will measure the displacement of the phase difference of signals (received from the two antennas of the interferometer) from that of a theoretical signal from the center of the sun and convert this to angular displacement which will determine position.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0018, MEASUREMENTS OF STRATOSPHERIC TURBULENCE OVER WATER
R.E. Good, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582820)

AF function - provide data to predict if there is a significant change in the environmental quality of the stratosphere as a result of flight of USAF aircraft and missiles. Deficiency - existing data on stratospheric transport are insufficient to accurately predict changes in stratospheric composition from small perturbations caused by aircraft and missile exhaust products. Objective - conduct and analyze balloon-borne observations of the characteristics of turbulence layers. How research contributes - measurements of the turbulence characteristics over level terrain, away from mountains, will be compared to previous measurements over mountains. These data will then be used to derive representative mixing coefficients and stratospheric pollution residence times over the United States. This will result in more precise environmental impact assessment of AF flight operations.

A balloon platform is used to carry a corona turbulence sensor that measures the intensity and spectral characteristics of

turbulence layers. The balloon will initially be allowed to rise to 90,000 ft., producing a vertical record of the location of turbulence layers. The balloon will then be forced to descend so to float in a turbulent layer for several hours to observe the time history of the turbulent layer. This will be repeated several times during the estimated ten-hour mission. A total of two balloon flights are planned with launches from Florida flying across the Gulf to Texas and launch from Chico, CA flying over the Pacific. Additional turbulence measurements will be performed using the recently developed smoke puff generator. These flights will be conducted at HAFB to thoroughly evaluate the new procedure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0019, MM RADIOMETER IMPROVEMENT

D.A. Guidice, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580840)

AF function - communications and surveillance. Deficiency -techniques to forecast the proton energy spectra of solar flarebursts require sensitive mm-wavelength observations. Present mm instrumentation (35 GHz) at Sagamore Hill is below state-of-the-art; a 35 GHz radiometer was not included in current RSTN equipment. Objective - to upgrade the Sagamore Hill mm-wavelength patrol equipment to improve sensitivity; this will then serve as the baseline for other RSTN units as needed. How research contributes - equipment upgrading and resulting improved sensitivity will lead to a more complete utilization of collected data for prediction.

The approach is to investigate the suitability, procure, test, and incorporate wide-band (greater than 100 MHz) intermediate-frequency components into the Sagamore Hill mm-wavelength radiometric instrumentation. Sensitivity will also be improved by incorporating suitable low-noise and/or low-loss waveguide components into the existing radiometer.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0020, DEVELOPMENT AND EXTENSION OF LOWTRAN TRANSMITTANCE AND RADIANCE MODEL

F.X. Kneizys, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583070)

AF function - detection, surveillance, discrimination, weapon delivery. Deficiency - inability to determine atmospheric attenuation and atmospheric background radiation under any given meteorological conditions. Objective - to develop techniques for predicting atmospheric transmittance and background radiance for any atmospheric path geometry and meteorological conditions, for any AF system application. How research contributes - provides models for assessing the performance of electrooptical systems under selected atmospheric conditions and attached geometry. Also provides for the optimization of the design of systems for any atmospheric conditions.

Current moderate resolution atmospheric transmittance and radiance model (LOWTRAN) will be updated and extended. New altitude- and relative humidity-dependent aerosol models will be added to the LOWTRAN model. Further comparison of LOWTRAN with measurements and degraded fascade spectral transmittance and radiance calculations will be made.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, WEATHER PREDICTION FROM SATELLITE IMAGERY

S.H. Muench, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584290)

AF function - weather observation, analysis and forecasting. Deficiency - lack adequate information to meet military weather support requirements. Objective - to develop and demonstrate techniques for short-range (0-6 hours) prediction of cloud and weather conditions, based primarily on geosynchronous satellite imagery data. How development contributes - successful development of these techniques will satisfy many of the requirements expressed in AWS GR No. 3-76 for continuously updated forecasts of mission-critical weather elements and MAC GOR 508-78 for real-time tactical weather observations.

Weather specification and prediction techniques developed in the prior efforts of IHWU 66700802 (statistical specification and prediction of cloud cover and precipitation) and IHWU 666700803 (displacement techniques in short-range forecasts of surface weather using satellite information) will be combined to formulate prototype prediction models which will be tested on archived data and then programmed and demonstrated on AFGL MCIDAS equipment. GOES satellite data collected in CY 79 for northeast U.S. will supplement prior archived data and be used to refine cloud and precipitation specification. Full disc GOES data to be collected in CY 80 will allow testing in other regions. The specification effort will be expanded to include other parameters, such as cloud base height, cloud thickness, and air mass visibility. Prototype forecast systems will be programmed and tested on the AFGL CDC 6600, using cases in the full disc archive. A version will then be programmed for the MCIDAS computer and demonstrated in real-time operation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, AURORAL AND AIRGLOW INFRARED STRUCTURE

R. Nadile, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584470)

AF function - infrared surveillance technology. Deficiency -insufficient knowledge of infrared background structure which can degrade surveillance systems. Objective - to investigate the spatial and temporal variability of infrared atmospheric emissions in auroral and disturbed airflow environments. How research contributes - accurate modeling of auroral and airglow clutter will provide a background predictive capability necessary for the design and optimization of i.r. surveillance systems.

Field measurements obtained by rocket, aircraft, satellite and ground-based sensors will be analyzed to determine the magnitude, scale size and frequency of spatial and temporal structure in aurora and airglow for different viewing geometries. Visible measurements, which comprise the largest fraction of the present data base, will be extrapolated to the infrared based on our current understanding of the species and mechanisms responsible for atmospheric structure. In FY 80 results from a dedicated infrared structures rocket experiment (ELIAS, ILIR7DZA) will be incorporated into the evolving model. This effort will also be coordinated with work units 76701008, aircraft measurements of infrared spatial structure, and 2310G412, auroral i.r. spectra.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, CHARGING CODE VALIDATION

A.G. Rubin, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF584700)

AF function - communications, surveillance and navigation. Deficiency - anomalous behavior of high-altitude satellites due to spacecraft charging. Objective - a 3-D SCATHA satellite computer model will be validated and verified. How research contributes - the SCATHA sheath model is required for interpretation of SCATHA data. The NASCAP code which contains the SCATHA model can model existing or proposed spacecraft for charging analysis, contamination studies and active control.

Computer plasma simulation codes such as the SATSS code and SCATHA/NASCAP codes and other codes to be developed or derived from existing codes will be validated and verified by exercising the codes in cases with known solutions or in simplified cases and by comparison of SCATHA flight data with code predictions. Code predictions to be validated include satellite photosheaths, charging at geosynchronous, differential charging, active control of satellite potential, prediction of detector operation and sheath structure.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, ENVIRONMENTAL ASSESSMENT OF THE NORTH ATLANTIC OUTER CONTINENTAL SHELF (GEORGES BANK)

J.M. Aaron, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *Woods Hole, Massachusetts* 02543 (9450-51823)

The goal of this environmental assessment of the Georges Bank area is to document the major geologic and oceanographic stresses affecting the region and the resulting potential hazards and impacts that may be encountered in petroleum exploration and development. Bottom photographs and long-term and seasonal data pertaining to current velocities and directions, water turbidity, temperature, and wave spectra will be obtained by instrument packages moored to the sea floor at several key locations in the area. High resolution seismic reflection data will be gathered to augment existing data in order to better define the nature and extent of slumping on the Continental Slope. Piston cores will be collected to characterize the composition, texture, age, geotechnical properties, and stability of surficial sediments on the Continental Slope. Side-scan sonar surveys will be carried out to study the mobility of large sand waves in the Georges Bank-Nantucket Shoals area.

The hydrographic data, integrated with meteorological information and other geologic and oceanographic data gathered in this program, will provide a better three-dimensional picture of the hydrography of Georges Bank, which will be critical in determining the trajectory and fate of spilled oil and other pollutants that may be introduced in development of activities. Sea bottom cores and seismic data will provide rational bases for assessing geologic hazards and will also contribute to a better understanding of the geologic evolution of the Continental Shelf and Slope off New England.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0025, FOREST LAND APPRAISAL FROM SERIAL PHOTOGRAPHS

C.E. Olson, University of Michigan, Ann Arbor Campus, School of Natural Resources, *Ann Arbor, Michigan* 48104 (0070625; MICY00093-F)

OBJECTIVE: Determine the feasibility of using air photos as primary data sources for implementing and extending the Michigan Land-Cover Classification Scheme as a unified basis for forest land appraisal in Michigan.

APPROACH: Michigan has recently promulgated a four-level Land-Cover Classification Scheme and projected that detailed information required at Levels III and IV will require extensive groundwork. It is hypothesized that careful measurement of tree height, crown diameter, and stand density can reduce the amount of groundwork required and permit extension of the scheme to include preliminary estimates of land value. Photo measurements for test sites in four counties will be compared with ground measurements of the same sites to test this hypothesis. Use of sequential photography to assess change over a several-year period and refine estimates of site quality is planned. Cost-effectiveness of different scales of photography in such appraisals will also be investigated.

PROGRESS: Changes in forest area, and accelerated soil erosion following forest clearing, proved mappable from LANDSAT imagery. Tests of sampling designs for determining change in forest land area of continental areas from LANDSAT data revealed that individual samples smaller than 1600 hectares give unsatisfactory results. Careful comparison of LANDSAT color composites with low altitude color-IR photography revealed that the high IR reflectance of broad-leaved forest stands results in partial forest-edge pixels consistently being classified as forest. This creates a positive bias with the area classified as forest being higher than actual forest area.

SUPPORTED BY Michigan State Government

5.0026, SOIL SURVEY AND SOIL CHARACTERIZATION, MINNESOTA

R.H. Rust, University of Minnesota, St. Paul Campus, Agricultural Experiment Station, Dept. of Soil Science, *St. Paul, Minnesota* 55101 (0001836; MIN-25-015)

OBJECTIVE: Inventory, classify, and make multiple use recommendations of the soils of Minnesota. Find and evaluate the principal physical, chemical, and mineralogical properties of the soil taxonomic units.

APPROACH: Within the guidelines of the National Cooperative Soil Survey, the Station will cooperate with the designated Federal agencies (Soil Conservation Service, Bureau of Indian Affairs, Forest Service) to initiate and complete detailed surveys in selected areas of the state. A present and continuing effort is to provide a large-scale (1:250,000) soil landscape unit map of the state by geologic quadrangles (total of 11) within a 4- to 5-year schedule. The preparation of interim interpretive reports of survey areas (prior to a final correlated soil map) will be made with emphasis on individual maps and associated interpretation. Continued effort will be made to process map information and characterization data (physical, chemical, mineralogical) in such manner as to facilitate automatic data processing which, in turn, will permit broader dissemination of the data to soil technicians.

PROGRESS: Continued effort on the detailed (1:20,000 or 1:24,000) soil survey of 17 counties is supported by the Legislative Commission on Minnesota Resources and by local units of government. The surveys of Clay and Dakota counties were completed. The progress of work was reviewed in Brown, Houston, Itasca, Jackson, Kandiyohi, Martin, Mower, Murray, Pennington, Redwood, St. Louis, Stearns, and Todd Counties. Laboratory characterization was completed on 310 profiles sampled in 19 counties where surveys are ongoing. The data on bulk density, cation exchange capacity, particle-size analysis, organic carbon, pH, 1/3 and 15 bar water retention is put in computer storage and recall. A special field and laboratory characterization of soils developed on drumlin topography and having higher density substratum was conducted in central Minnesota. To expedite publication of survey reports all manuscripts are entered in word processor beginning with the initial field report. All map compilation work is photographed on 35 mm slides for digital image processing and storage. Work continues on the publication of the Minnesota Soil Atlas series. Of 11 sheets, 5 are now published. (Text Abridged)

SUPPORTED BY Minnesota State Government

5.0027, ATMOSPHERIC ABSORPTION OF RADIATION BY WATER

R.H. Tipping, University of Nebraska, Lincoln Campus, Graduate School, *Lincoln, Nebraska* 68508 (DF057860; AFOSR-80-0058)

AF function - many Air Force systems depend upon infrared (IR) transmission in the free atmosphere. Signal loss over distance is, in part, strongly dependent upon continuum absorption by water vapor in the 8 to 20 micrometer wave length region. A thorough understanding of atmospheric effects upon IR transmission is necessary to provide both operational and research support to the development and evaluation of AF systems. Deficiency - lack of understanding of the water vapor absorption in the continuum region includes generation of adequate transmission codes for Air Force programs involving IR transmission. Systems development will shortly outpace theoretical support, adversely affecting future efforts. Objective - the goal is to investigate the water vapor absorption continuum region and define the absorption line structure in order to adequately model the true physics of the continuum absorption. How work contributes - results will be immediately incorporated into AFGL transmission models which are distributed through DOD FRO visible/IR transmission research pertaining to systems development and evaluation.

To be addressed are three specific question areas crucial to understanding water vapor continuum absorption: (1) What is the representation of the shape of individual dipole allowed lines over their entire contours? (2) What is the importance of overlapping lines in the computation of a synthetic spectrum by a superposition of individual lines? (3) What is the importance of collision-induced contributions to the observed spectrum. Understanding these topic areas will add greatly to basic understanding and allow modification of the 'far wings' of the usual Lorentzian line shapes for a more realistic description of the absorption process.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0028, ADHESION AND PHYSICS OF ICE
D. Itagaki, U.S. Dept. of Defense, Army, Corps of Engineers, Cold Regions Research & Engineering Lab., *P.O. Box 282, Hanover, New Hampshire* 03755 (DA0D8151)

To provide fundamental knowledge of the mechanisms and properties of ice adhering to surfaces of fixed and rotary-wing surfaces as well as other surfaces where the accretion and adhesion of ice interferes with the operation of materiel. To establish basic principles involved in the development of methods and techniques to remove ice from surfaces. To explore and develop means to prevent and/or alleviate icing. To evaluate and predict incidence and intensity of icing on the basis of readily available meteorological parameters.

The required information will be generated by a coordinated sequence of investigations including microscale evaluation of the physics and properties of ice adhering to interfaces, examination of the mechanisms of crack propagation in ice near an interface, and investigation of the interrelationships and influences of electrical properties on the mechanical properties of ice. Studies will also be pursued to determine in more detail the actual mechanism of accretion with attention centered on the freezing process of small droplets from the time they first impact to the time when they are frozen (accreted) or removed by the ambient air stream. Information developed will be disseminated to users and other project participants to provide a basis for improved design and performance of materiel. Foreign state-of-the-art is being considered.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Cold Regions Research & Engineering Lab.

5.0029, RESOURCE INVENTORY AND ANALYSIS FOR FOREST LAND USE PLANNING
L.S. Hamilton, Cornell University, Ithaca Campus, Agricultural Experiment Station, McIntire Stennis Program, *Ithaca, New York* 14850 (0010760; NYC-147552)

OBJECTIVE: Evaluate the usefulness of various kinds of natural resource information, how it may best be obtained and how it may be used in multiple use planning for forest and wildlands, and in determining alternate uses of forest lands. Study the impacts of selected resource uses on forest and related lands through resource inventory and analysis.

APPROACH: Through a series of subprojects: develop a method of biophysical land classification which is integrated with economic and social considerations to guide programs and land uses on upper watersheds where low technology inputs are appropriate; consider the land use and environmental effects of high, extra high and ultra high voltage transmission lines on forest and related lands, and the methods of securing resource information for location planning (this will be based on previous work under this project); assess the extent to which biophysical parameters have historically affected forest land use.

PROGRESS: A rapid, low-cost method of forest land assessment and capability classification has been developed. It combines the Holdridge life zone bioclimatic classification with the identification of landscape units which are recognizable on air-photos, and which are relatively homogeneous with respect to geology, soils, topography and vegetation. Based on the assumption that these units will tend to respond in similar fashion to the same kind of treatment, capability potentials were rated for timber and fuel-wood production, protection function, reforestation, grazing and seven kinds of commonly raised agricultural crops. This was done for a 160,000 hectare watershed in Venezuela in two man-years. The methodology has been welcomed by the Venezuelan government, which will run training schools. The method will be publicized by an article in an international journal, and at a symposium on forest land assessment to be held in June 1979 at the East West Center in Hawaii.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, New York

5.0030, PRECISE ESTIMATE OF THE EARTH'S GRAVITY FIELD
R. Rapp, Ohio State University Research Foundation, *1314 Kinnear Rd., Columbus, Ohio* 43212 (DF582570; F19628-79-C-0027)

AF function - study factors effecting precise determination of earth's gravity field. Deficiency - lack of suitable technical data for aerospace systems requiring precise gravity input. Objective - improved position determination and inertial alignment. How research contributes - provides technology to collect and interpret improved gravity data derived from currently inaccessible terrestrial areas.

Study global height reference systems by examining the unification of the various leveling networks that exist in the world today in order to see if it is feasible to develop a common gravity anomaly basis. Additionally, satellite altimetry data taken over land masses will be investigated to determine if it is practical to interpret such data for gravitational field improvement.

SUPPORTED BY U.S. Dept. of Defense, Geophysics Lab., Terrestrial Sciences Div.

5.0031, SPATIAL AND TEMPORAL VARIABILITY OF PRECIPITATION IN THE PACIFIC NORTHWEST
D.M. Johnson, Oregon State Higher Education System, Oregon State University, School of Science, Dept. of Geography, *126 Agricultural Hall, Corvallis, Oregon* 97331 (A-050-ORE)

RESEARCH OBJECTIVES: a. To define and document the spatial pattern and variability of seasonal and annual precipitation and to identify homogeneous precipitation regions. b. To examine the historical record to determine the nature and magnitude of short-termed precipitation fluctuations. c. To identify the spatial variations of these fluctuations in terms of the developed precipitation regions.

RESEARCH APPROACH: Existing data and collection systems will be examined and evaluated; a statistical analysis will be conducted to establish climatic characteristics; a historical analysis will determine any changes in inter-annual variability at long-term stations; finally, findings will be related to secular climatic fluctuations throughout the west.

SUPPORTED BY U.S. Dept. of the Interior, Office of Water Research & Technology

5.0032, MULTI-IMAGE AUTOMATED INTERPRETATION TECHNIQUES (DAU8041)
Unknown, General Electric Co., *3198 Chestnut St., Philadelphia, Pennsylvania* 19101 (DA0G2484; TO BE DETERMINED)

To develop, test, and evaluate digital and analog automated image processing techniques, routines, and algorithms for extracting terrain information or features for topographic maps, and MGI using panchromatic, multispectral (LANDSAT), radar, and infrared remote sensor imagery or computer-compatible tapes as input. Digital/analog image factor map complexing and camouflage detection are secondary objectives.

Identify digital image processing and pattern recognition software to be developed under contract. Develop extraction techniques using LANDSAT, panchromatic, radar, and infrared inputs separately and together for automated extraction of terrain data.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Data Processing & Products Div.

5.0033, COOPERATIVE OBSERVATIONS OF OPTICAL EMISSIONS DUE TO ENERGETIC NEUTRAL ATOM PRECIPITATION (THE EQUATORIAL AURORA)
B.A. Tinsley, University of Texas, Dallas Campus, Center for Space Sciences, *Richardson, Texas* 75082 (INT79-03438)

Professor B.A. Tinsley of the University of Texas at Dallas and Dr. Y. Sahai and Dr. N. Teixeira of Brazil's Institute of Space Studies will study optical emissions from the equatorial upper atmosphere. Such emissions have been observed from satellites and Dr. Tinsley has performed theoretical analysis of the emission effect. Analysis of the relative intensities and time variations of the emissions from hydrogen, helium, oxygen and nitrogen will give information on the time variation of ionic composition and energy distributions of ions in the atmosphere's ring current. The observation site near Sao Jose dos Campos, Brazil, is at the optimum latitude for observation of the energetic particle effects. Existing equipment will be modified and

tested in the U.S. and then shipped to the Cachoeira Paulista site between Sao Paulo and Rio de Janeiro.

SUPPORTED BY U.S. National Science Foundation, Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

5.0034, ERROR STATISTICS FOR ASTRO-GEODETIC POSITIONS FOR RGSS TEST COURSE (DA0N8107)
A.A. Baldini, U.S. Dept. of Defense, Army, Corps of Engineers, Engineer Topographic Lab., *Fort Belvoir, Virginia* 22060 (DA0G0259)

To provide error statistics for the observed series of conventionally determined astro-positions (developed inertial test course in Maryland) with respect to station internal precision, station absolute accuracy, and station-to-station deflection changes accuracy. The objective for such a set of statistics is to permit an equitable assignment of observed errors occurring in rapid geodetic survey system (RGSS) vertical deflection testing.

The researcher will employ conventional techniques and utilize his own new techniques to assess the various statistical characteristics as indicated in the technical objectives. The analyses will designate atmospheric vertical refraction error contributions to the modified Sterneck latitude method, the appropriate time period dynamic refraction bias for the Sterneck latitudes, star catalog errors with respect to the operational scheme used, the uncompensated instrumental errors, time delay errors for the transit longitudes, and transit longitude errors resulting from the instrument being out of the meridian and being continually reset between north and south.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Engineer Topographic Lab.

5.0035, TRACE ELEMENTS IN PLANETARY MATERIALS BY ACTIVATION ANALYSIS
J.W. Morgan, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (9770-2168)

The compositional and metallographic variation of metal particles with petrological group in H and L chondrites will be studied; and a similar investigation of shocked chondrites will be completed. In lunar soils, the analysis of metal particles derived from local crater-forming impacts may identify meteorite types otherwise obscured in bulk soils. A bone of contention has been whether the siderophile elements in Apollo 15 green glasses are of meteoritic or of indigenous lunar origin; new analyses of a wider range of elements should resolve this question. The pallasites represent a natural system in which FeNi is in equilibrium with olivine and FeS; we will attempt co-existing phases by appropriate elemental analysis. The chemical, morphological and metallographic characterization of iron meteorites recovered from ice-ablation areas of Antarctica will be actively pursued.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0036, X-RAY SPECTROSCOPY
H.J. Rose, U.S. Dept. of the Interior, Geological Survey, Geologic Div., *12201 Sunrise Valley Dr., Reston, Virginia* 22092 (9770-00452)

X-ray spectroscopy, electron microprobe, and transmission and scanning electron microscopy are main areas of instrumentation. Major objectives are the development of methods and techniques for the bulk and micro-analysis of geologic specimens. An automated fully focusing X-ray spectrometer has been built and is currently being tested for automatic trace element analysis as well as indicating a 10- to 20-fold increase in intensity for the elements F to Si. An energy-dispersive spectrometer has been recently installed and application to major and trace element analysis is being investigated.

Studies currently in progress include chemical and mineralogical characterization of polished coal mounts, peats and coal ashes, unconsolidated sediments from the Atlantic coastal plain, phosphorus distribution in the Potomac tidal waters, as well as the active support of other survey investigations requiring micro-mineralogical and chemical analysis. Participation in the Viking Mars program continues with the preparation and analysis of Martian analog samples. Automated sample preparation techniques are also under study.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0037, SATELLITE IMAGE ATLAS OF GLACIERS
R.S. Williams, U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office, *12201 Sunrise Valley Dr., Mail Stop 710, Reston, Virginia* 22092 (7030-24029)

During the first half of FY 1980, the editors will complete the distribution of several thousand LANDSAT images and maps and other relevant information to authors of the 12 geographic area chapters and the 8 topical chapters. The project now includes the active involvement of 55 glaciologists and scientists in related disciplines from 30 U.S., foreign, and international organizations, including the USSR, PRC, Canada, England, Scotland, Argentina, France, Switzerland, Austria, Turkey, India, Japan, New Zealand, Iceland, Denmark, Norway, Australia, Sweden, Germany, and Peru. During the second half of FY 1980, the editors will write the introductory chapter and appendices, will start reviewing manuscript material submitted by the contributing authors in preparation for publication of the 'Satellite Image Atlas of Glaciers.'

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Land Information & Analysis Office

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, AUTOMATED ADAPTIVE TRAINING FOR THE LANDING SIGNAL OFFICER
R. Breaux, U.S. Dept. of Defense, Navy, Naval Training Equipment Center, Human Factors Lab., *Orlando, Florida* 32813 (DN794013)

To develop, implement and test, in the context of an automated trainer, techniques for training which will improve the training progress of the landing signal officer (LSO) and thereby reduce cost in manpower and equipment, through development of models of the LSO task and pilot-LSO interaction. Use of modeling techniques can increase training effectiveness by providing objective performance measurement and guidance in skill acquisition at any point in the training process.

The effort consists of: (1) identification of visual and auditory cues; (2) development of models of the visual scene, pilot response, and pilot-LSO interaction; (3) application of voice recognition, performance measurement, and automated adaptive training technologies; and (4) empirical test of effectiveness of the training system.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Human Factors Lab.

6.0002, AERODYNAMIC/INERTIAL RESPONSE ANALYSIS
P. Payne, Payne Inc., *Annapolis, Maryland* (DF325380; F33615-79-C-0527)

Seven percent of the major injuries that result from emergency escape from military aircraft under noncombat conditions are attributable to aerodynamic forces. Under combat conditions, where the ejection velocities are higher, the wind-blast injury rate has been at least 26 percent. Solution of this problem requires that the escape system designer understand the characteristics of all of the forces that act simultaneously or sequentially on the crew member during the escape process. The objectives of this research effort are to conduct an analysis of the aerodynamic and inertial forces acting on the human body during escape using available data to provide design criteria for protective equipment design and, where necessary, to improve the analytical methods and design future experimental efforts to substantiate these methods.

The research involves: 1. the consolidation and analysis of all available aerodynamic data on the human body with particu-

lar emphasis on extremity flail-potential loads; 2. adapting the consolidated data for use with the AMRL/articulated total body (ATB) model, computer model of an aircrewman's body; 3. acquiring data on the inertial forces acting on the crewman due to the action of ejection catapults, rockets and aerodynamic decelerators; 4. exercising the model using both inertial and aerodynamic data in comparison with actual USAF flail injury experience; and 5. determining what additional experimental information is needed, and planning additional wind tunnel program (or programs) to obtain it.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Biodynamics & Bionics Div.

6.0003, DYNAMIC ENVIRONMENT SIMULATOR - OPERATION AND MAINTENANCE

E.F. Mersereau, Raytheon Service Co., *Burlington, Massachusetts* 01803 (DF312430; F33615-80-C-0500)

To provide contract support for the operation and maintenance of the dynamic environment simulator (DES). The DES is a closed-loop double-gimballed human centrifuge capable of simulating many of the stress environments encountered in air combat and other flight conditions.

Beryllium deposition in bone, the major storage depot, and the ultra-microscopic pathology of subcellular organelles will be investigated using electron microscopy, electron and X-ray diffraction, and other advanced analytical tools. This basic information is directly applicable to the development of methods to evaluate the potential hazards of beryllium compounds of interest to the Air Force, aircraft industry, and NASA, and to diagnose, prognose, and treat accidental exposures.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Biodynamics & Bionics Div.

6.0004, CHANGES IN THE ORGAN OF HEARING PRODUCED BY SOUND

D.J. Lim, Ohio State University, Columbus Campus, School of Medicine, Dept. of Otolaryngology, *370 W. 9th Ave., Columbus, Ohio* 43212 (DF322410; F33615-77-C-0512)

The purpose of this work unit is to examine changes in the auditory system produced by exposure to excessive sound. The effort will emphasize studies in the infrasound (1-20 Hz) region and long-term, low-level exposures at mid-frequencies (600-2000 Hz). Goal of the research is a reasonable hypothesis of the mechanism of injury production that provides a rationale for treatment and prevention. Results of this basic research are used in the AMRL applied technology program in establishing guidelines for limits of exposure and methods of protection from exposure to excessive sound. Ultimately, this forms the basis for Air Force regulations governing exposure and protection criteria. Data are also used by the Environmental Protection Agency.

Infrasound exposures will be carried out only on experimental animals. Long-term, low-level exposures will be carried out on experimental animals and human volunteer subjects at levels which do not produce permanent changes in hearing. Techniques to be employed include light and electron microscopy of inner ear structures, electrophysiological measures of middle ear muscle activity and psychoacoustic measures of changes in auditory acuity.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Biodynamics & Bionics Div.

6.0005, SENSOR SIMULATION FOR TARGET ACQUISITION TRAINING

J.C. Simons, Systems Research Lab. Inc., *500 Woods Dr., Dayton, Ohio* 45432 (DF228750; F33615-78-C-0061)

Analytical and preliminary empirical experimentation to determine specific dependent and independent variables that can be used in studies of the adequacy of computer-generated imagery for training sensor operators. The results of this research will be used in studies which will compare real-world with emulated imagery conducted under work unit 2313-T3-05.

Preliminary effort will review information on the training of sensor operators and the procedures used in operational systems. Strategic Air Command (SAC) crew members will be interviewed to obtain information on tasks and strategies associated with target acquisition during terrain-avoidance flying. Specific tasks will be selected as candidate dependent variables to compare real-world with emulated scenes of forward-looking infrared (FLIR) and low-light-level television (LLLTV) sensor systems. These variables will be tested in a limited number of preliminary experimental studies. Specific variables and techniques will be recommended to the government for testing the adequacy of CGI for training sensor operators. Major milestones include identification of variables for test (9 MAC), conducting experimentation and analysis (24 MAC), and documentation (26 MAC).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0006, BIODYNAMIC CRITERIA FOR DEVELOPMENT AND EVALUATION OF LIFE SUPPORT SYSTEMS

J.W. Brinkley, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF322780)

The life support systems program office of the Aeronautical Systems Division conducts a research and development program to provide an integrated assemblage of components, techniques and training required to assure aircrews and their passengers the best possible flight environments for conducting combat and peacetime Air Force missions. This effort includes provision of safe and reliable escape, descent, survival and recovery in emergency situations. The objective of this work unit is to provide aeromedical design criteria for the development and evaluation of life support systems such as emergency escape systems, personnel restraint systems, and flight helmets. Biotechnology data are applied to insure aircrew safety within the transient mechanical stresses associated with emergency flight conditions, e.g., ejection acceleration, aerodynamic deceleration, aircraft crash, etc.

Technical support is provided on specific life support systems programs in response to letter requests and memoranda of agreement submitted to the Aerospace Medical Division by the life support systems program office. Support includes analysis of escape system designs to assure adherence with biodynamic design criteria, development of design criteria for new protective systems, assessments of current operational problems, and test and evaluation of developmental systems. The ASD helmet test facility is operated and maintained under this work unit. Technical consultation is also provided on the development of the high technology ejection seat.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Biodynamics & Bionics Div.

6.0007, VISUAL PERCEPTION THROUGH WINDSCREENS

R.G. Eggleston, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321120)

To relate the optical characteristics of aircraft forward transparencies to specific aspects of visual performance. F-111 and new geometric configurations will be evaluated. Optical deficiencies include distortion, binocular disparity, multiple imaging birefringence coloration and transmission loss. The ultimate goal of this work unit will be the development of a set of visual perception measures to be used in acceptance testing of aircraft windscreens. These measures will influence the selection of optical tests. Data collected under this work unit using these measures will form the basis for setting of optical specifications.

Through ground-based laboratory experimentation, this research program will be directed toward the determination of performance-limiting changes in visual perception produced by optical deficiencies in aircraft windscreens. Results will be interpreted with respect to measures of windscreen optical quality. Examination of the effects of optical distortion requires tests of (a) visual acuity, both static and dynamic, (b) motion perception

in terms of movement thresholds, velocity estimations, and two-dimensional eye-tracking accuracy, (c) distance perception with respect to static and dynamic targets, and (d) depth perception, both near and far field. The distracting influence of multiple imaging will be investigated by monitoring three-dimensional eye-tracking accuracy, while birefringence coloration effects will be determined by measuring the changes in accommodation that are produced. For all testing situations, short-term viewing influences will be differentiated from long-term viewing influences. Visual quality inspection process will be categorized, psychometrically quantified and related to optical, pilot and laboratory performance measures.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Human Engineering Div.

6.0008, BIOASSAY IN SOIL MICROORGANISMS

S.A. London, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF320500)

To utilize microbial systems for evaluating the potential environmental impact of various materials used in Air Force operations, such as missile propellants, aircraft fuels and lubricants and other substances used in consequential amounts that could have acute and/or chronic environmental effects. The data derived from this effort are considered in conjunction with similar results obtained with other biological indicator and test systems to form a data base upon which scientifically valid environmental impact assessments and statements can be prepared. The microbial bioassay portion of work unit 6302-04-11 was transferred to this work unit.

Microbial cultures isolated from soil samples will be investigated concerning their responses to both acute and chronic exposure to potential environmental pollutants. Selection of species will be based upon (1) applicability of physiological requirements to experimental procedures, (2) relationship of responses to pollutant exposure with ecosystem impact. Microbes will be studied under both closed (batch) system and open (steady-state growth) system conditions to ascertain acute and chronic effects. Responses to be evaluated will include growth kinetics, bacteriocidal/bacteriostatic effect, physiological changes, genetic (mutation) effects, pollutant degradation or accumulation. This effort will establish no-effect levels for single and multiple cultures and will serve as both a laboratory test system and a means of predicting potential environmental consequences of inadvertant intrusion in soil and water of Air Force materials.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Toxic Hazards Div.

6.0009, UPDATE AIRCRAFT NOISE FILES INTEGRATING ADDITIONAL SOURCES PLUS ESA AND DEFLECTOR STUDY RESULTS

J.D. Speakman, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325770)

The AMRL noise files contain the aircraft flight and ground run-up basic noise data used by the NOISEMAP environmental noise exposure predictive procedure. It is essential that these noise files be continuously updated to include new aircraft as they are developed, and that they be modified as required, consistent with improvements in the state-of-the-art, to insure the continuing technical credibility of the environmental noise impact assessments made Air Force-wide using these data.

Noise-measuring instrumentation, test protocols, and data reduction techniques previously developed by AMRL will be used to insure continuity with prior data acquired and analyzed on over 40 aircraft. Modifications to the noise files will be done systematically to reflect proven results from work unit 72310704 on excess sound attenuation and revisions in accepted national or international standards on noise propagation and prediction methodologies.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Biodynamics & Bionics Div.

6.0010, MORTALITY AND INDUSTRIAL HYGIENE STUDY OF FUEL MEN

W. Halperin, U.S. Dept. of Health & Human Services, Public Health Service, Center for Disease Control, National Inst. for Occupational Safety & Health, Division of Surveillance Hazard Evaluations & Field Studies, *4676 Columbia Pkwy., Cincinnati, Ohio* 45226 (VMH-C22-657)

Workers who load jet fuel (kerosene) into commercial aircraft at JFK Airport in New York are exposed to kerosene, carbon monoxide from vehicular exhaust and aircraft exhaust, which includes a gemische of aliphatic and aromatic hydrocarbons. A preliminary investigation in response to an HHE alleging unusual death rates has uncovered several findings: 1) two of 31 deaths are due to multiple myeloma which represents an unusual fraction, and 2) maintenance and design of vehicles may allow excessive exposure to carbon monoxide. A cohort mortality study with industrial hygiene characterization of the worksite is planned.

SUPPORTED BY U.S. Dept. of Health & Human Services, Center for Disease Control, National Inst. for Occupational Safety & Health

6.0011, NAVY ENVIRONMENT - ANALYSIS OF ELECTROPHYSIOLOGICAL SIGNALS FROM ANIMALS SUBJECTED TO BIODYNAMIC STRESS

B. Saltzberg, Texas Research Inst. of Mental Sciences, *1300 Moursund Ave., Houston, Texas* 77025 (DN675488; N00014-76-C-0911)

This effort is to assist in the correlation of the dynamic changes in electrophysiological activity with changing acceleration profiles in the specially controlled biodynamic experiments being conducted at Naval Aerospace Medical Research Laboratory, Detachment, New Orleans. Objective is to characterize the neurophysiological response of non-human primates to various types of biodynamic stress.

Through use of computers, computer modeling and high-time resolution technique, a major thrust of this continuing effort will be to obtain rapid-time resolution of changes in nerve propagation which occur during the acceleration impact. Evoked response data will be tracked before, during and after biodynamic stress; algorithms for achieving high-resolution assessment of changes in evoked potential waveshape will be developed and experimental data from the NAMRL/D research activities will be analyzed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

6.0012, SELECTION FOR NAVIGATOR TRAINING

H.E. Jensen, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF234220)

Identification of characteristics of superior navigators in operational roles, investigation of experimental cognitive and non-cognitive measures, the recommendation of improvements in the UNT screening battery.

Newly revised navigator training programs will be reviewed. Approximately 300 UNT candidates will be administered a battery of psychomotor, perceptual, and information processing tests as well as the AFOQT. These measures will be examined in light of subjects' performance in UNT, CCTS, and in an operational role. Exit interviews will be conducted with those who are dismissed from either UNT or CCTS and aircraft assignment preferences will be examined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0013, EVALUATION OF AIRCREW ANTI-RADIATION DRUGS

R.E. Cordts, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF323860)

To evaluate the effectiveness of promethazine, cimetidine, and thiethylperazine in all combinations to alleviate the emetic episodes which often occur following exposure to gamma irradiation. To identify other drugs which may be effective. Also,

to determine the degree of drug effectiveness to alleviate emetic episodes comparing exposures to gamma or neutron irradiation.

Determination of the most effective drug or combination of drugs to eliminate the emetic episodes of gamma radiation will be accomplished using constant doses of drugs and varying the amount of radiation exposure to each subject in an up-down schedule of exposures. The drug or combination of drugs most effective in the gamma radiation exposures will be tested to determine its ability to reduce the incidence of emesis following exposure to neutron-rich radiation. Additional drugs recently identified as possibly having benefit in reducing emetic episodes following radiation will be tested in a like fashion.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0014, CLINICAL STUDY GROUPS - CARDIOVASCULAR CRITERIA FOR AIRCREW SELECTION AND RETENTION

J.R. Hickman, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF321590)

Minimize the number of fliers who must be grounded because of the presence of circulatory and respiratory disease. It will be necessary that the significance of the abnormal response to testing procedures in regard to flying performance and safety be better quantified. This effort will accomplish this by establishing the functional and prognostic nature of abnormalities through long-term follow-up employing newly developed measurement techniques.

Approaches will be developed to allow more precise evaluation of cardiovascular functional integrity and capability in the presence of abnormalities to allow retention of more crewmen in flying duties than previously possible. Techniques will be developed to improve the ability to detect potential problematic disease earlier and permit a more productive preventive approach. Longitudinal studies to assess the significance of disease in aerospace operations coupled with the intensive study of patient groups with specific problems (e.g., acquired bundle branch block) will yield definitive information to help formulate or modify medical standards for aircrew selection and retention. Work was formerly documented under work unit 7755-01-04.

SUPPORTED BY U.S. Dept. of Defense, School of Aerospace Medicine, Clinical Sciences Div.

6.0015, INTEGRATED AEROMEDICAL DATA BASE AND DECISION SYSTEM

G. Tolan, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF322070)

The primary objective of the integrated aeromedical data decision system is to facilitate follow-up studies on fliers evaluated in the past in order that waiver authorities can better determine whether today's fliers with the same findings should be returned to duty. Additional objectives include identifying candidates for special studies, determining the probability of obtaining a waiver for any given condition, and describing the medical profile of special study groups.

In order to reduce data capture errors, state-of-the-art as well as innovative methods will be implemented that capture data as close in time and place to its creation as is possible. Data will then be machine-verified and echoed back to their sources for reconfirmation. In order to permit correlation of a patient's data across different source-oriented medical data repositories, an algorithm for verifying each patient's unique identifier will be implemented. In order to protect uniquely identifiable medical data from unauthorized access or alteration, while simultaneously increasing the data availability to the end-users, repositories will be incorporated into a data base management system. Efforts were previously under work unit 7755-14-08.

SUPPORTED BY U.S. Dept. of Defense, School of Aerospace Medicine, Clinical Sciences Div.

6.0016, DATA MANAGEMENT SYSTEM FOR STRESS STUDIES

S. Samn, U.S. General Services Admin., *Fort Worth, Texas* (DF324460)

The purpose of this effort is to set-up a data management/retrieval system to handle experimental data that were gathered and to be gathered at the USAF School of Aerospace Medicine for the purpose of making aircrew stress assessments. The intent is to organize these data in an orderly way and in an easily accessible manner so as to help the investigators at USAFSAM perform their research, and more importantly, to help them provide more timely and accurate crew work load guidance to field commands.

The first phase of this effort is a problem definition phase in which the problem is explicitly defined. This will be followed by a feasibility study to find out which is the best way to address the problem, and this, in turn, will be followed by a design phase and finally an implementation phase where the system is set-up.

SUPPORTED BY U.S. Dept. of Defense, School of Aerospace Medicine, Biometric Div.

6.0017, DETERMINATION OF THE DYNAMIC RESPONSE CHARACTERISTICS OF VERTICAL VESTIBULAR SYSTEMS AS RELATED TO SPATIAL ORIENTATION

M.J. Correia, University of Texas, Medical Branch at Galveston, School of Medicine, Dept. of Otolaryngology, *300 University Blvd., Galveston, Texas* 77550 (DN675266; N00014-76-C-0622)

Naval personnel are frequently exposed to non-physiological vestibular stimulation, e.g., aircraft launch, acceleration, deceleration, low level flight, etc., which often results in illusions of motion and at times disorientation, with consequences ranging from mild performance decrement to nausea and vertigo. This work unit will provide data to better define the dynamic interaction of the vestibular and visual systems believed responsible, and perhaps suggest techniques for reducing the effects.

Work will continue on (1) examination of the dynamic response characteristics of the vertical vestibulo-ocular reflex (VVOR) with changes in absolute eye position, and (2) examination of the VVOR during concomitant visual, angular and dynamic linear acceleration stimuli following selective bilateral sectioning of some of the nerves innervating different parts of the semicircular canals.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

6.0018, ADVANCED REQUIREMENTS AND TRAINING TECHNOLOGIES (TECH BASE)

D.O. Weitzman, U.S. Dept. of Defense, Army, Research Inst. for the Behavioral & Social Sciences, Educational Technology & Simulation Technical Area, *5001 Eisenhower Ave., Alexandria, Virginia* 22333 (DA644393)

This work is designed to develop new methodologies for training navigation skills which accommodate systematic individual differences in information processing abilities. Further, it is designed to determine the basic information processes required to make navigational judgments.

Experimental research will determine the processing strategies that soldiers use while navigating. Particular attention will be devoted to the night navigation problems. Individual differences in processing strategies will be incorporated in new training methodologies when identified.

SUPPORTED BY U.S. Dept. of Defense, Army, Research Inst. for the Behavioral & Social Sciences

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, MATHEMATICAL THEORY OF NONLINEAR WAVE PROPAGATION

G.B. Whitham, California Inst. of Technology, Graduate School, Dept. of Applied Mathematics, *1201 E. California Blvd., Pasadena, California* 91109 (DN525213; N00014-75-C-0702)

The mathematical research being done under this task responds to naval requirements for prediction and control of physical phenomena in the fields of oceanography, meteorology, gas dynamics and plasma physics. The mathematical theory of nonlinear wave propagation is particularly relevant to naval research in oceanography. This work provides fundamental insight into the propagation of both internal and surface waves and water waves on a beach.

Research is being done in the mathematical theory of nonlinear wave propagation and related problems in the general theory of partial differential equations. This work includes the investigation of waves on beaches, nonlinear wave instabilities and exact solutions of Korteweg-Devrics and related equations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

7.0002, INVESTIGATION OF STOCHASTIC CONTROL SYSTEMS

H. Kushner, Brown University, Graduate School, Dept. of Applied Mathematics, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DN123377; N00014-76-C-0279)

Modern weapons systems and automatic ship and aircraft steering systems require more powerful mathematical methods of solution and analysis of complex control systems. It is the purpose of this research to study control problems in which statistical noise is present. This can be taken to represent uncertainties in the atmospheric or ocean environment, exact values of important parameters, etc.

The principal investigator will seek computational algorithms for computing optimal stochastic controls or useful approximations to them. This work will use techniques from a wide range of mathematical areas including probability theory, differential equations, and numerical analysis.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

7.0003, COMPUTATIONAL METHODS IN NONLINEAR MECHANICS

J.T. Oden, University of Texas, Austin Campus, School of Engineering, Dept. of Aerospace Engineering & Engineering Mechanics, *200 W. 21st, Austin, Texas* 78712 (DF052690; F49620-78-C-0083)

AF function - aerospace vehicles. Opportunity - accurate analysis and prediction of structural response in the nonlinear, large deformation, inelastic range has major potential to reduce weight, decrease cost and increase performance and life of vehicles and weapon system components. Objective - to achieve accurate, reliable and efficient analytical, computational and design tools and methods for structural components which operate in the nonlinear regime. How work contributes - directly. Finite element methods, properly developed and implemented, make the transition from research to application very quickly.

Expand the contact problems studied during the first two years of this project to include friction and bifurcation effects. Continue, and broaden, the study of finite deformation of elastic bodies. Undertake a detailed study of finite deformations of inelastic materials, with emphasis on metal-forming problems. As previously, investigate the reliability, quality and numerical stability of the approximation and computation methods developed, to include a priori and a posteriori error estimates. The efficient methods developed will be implemented and used to solve representative problems. Results will be disseminated in the literature, by presentation at meetings, and by direct interaction with Air Force technical personnel.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, STUDY OF SOLAR OSCILLATIONS

H.A. Hill, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (DF057050; AFOSR-80-0049)

AF function - USAF long-range communication, surveillance, navigation and detection systems are affected by the ionized environment in near-earth space. This environment is maintained by radiation from the sun and particles from the solar wind and changes in response to solar activity. Deficiency - standard theory of stellar evolution cannot predict the observed properties of the sun, such as radius, photon and neutrino luminosity and surface rotation rate. Objective - to study the internal structure of the sun by measuring and classifying solar oscillations. Contribution - normal modes of solar oscillations can become a diagnostic probe to provide information about the interior of the sun.

An observational and theoretical program will classify the normal modes of vibration of the sun and use the results to study the sun's internal radial structure and rotation. Observations will be made with improved frequency resolution by using continuous data sets over periods of weeks. The surface harmonic structure will be studied by making simultaneous observation of multiple solar diameters and by using techniques to define the position of the solar limb. Rotational splitting of the modes as an indicator of the internal rotation rate will be studied by observing beats in the power of a particular peak or directly by mode identification schemes. A theoretical study will be conducted on boundary conditions used in solar and stellar pulsation calculations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0002, FUNDAMENTAL EXPERIMENTS AT LIQUID HELIUM TEMPERATURES

W.M. Fairbank, Stanford University, School of Humanities & Sciences, Dept. of Physics, *Stanford, California* 94305 (DF027070; F44620-75-C-0022)

AF function - the proposed research primarily falls in the 7.1 research objectives which deal with reconnaissance and surveillance. In particular, the experiments involving the production and trapping of very low energy ground-state electrons in a weak magnetic field lead to a photon-counting millimeter wave detector. AF operations require the search and mapping of regions of interest in real- or near-real-time in order to detect, identify, locate, count or investigate weapons, personnel, vehicles, installations by microwave, electronic and other sensing methods. Deficiency - the far infrared portion of the electromagnetic spectrum is an underdeveloped area that potentially could contribute significantly to remote sensing. This probable interaction of such radiation with materials along with high atmospheric transmission in many bands and especially at the longer wavelengths gives rise to interest regarding potential reconnaissance or surveillance application. Objective - they propose to continue their investigation of the temperature-dependent anomalous shielding effect which we observe on the surface of a copper tube at liquid helium temperatures. During the present contract year they expect to conclude experiments which will determine the behavior of the shielding effect at temperatures below 4.2 K (probably down to 2.5 K or so) and which will yield improved measurements in the 4.2-9 K region. Contribution - this research is part of a comprehensive program in low-temperature physics.

During the next year the development of the electron/positron thermalization as a photon-counting detector will be continued. Optimization of the device for use in the surface shielding work will be directed toward operating the thermalizer with a positron beam. The problems of interfacing the thermalizer to the time-of-flight apparatus include minimizations of physical size, magnetic field matching and shielding of the high energy particles emitted by the radioactive source at the ejector stage of the thermalizer. Use of the thermalized electron source will allow significant improvements in counting statistics and, because of the reduced time needed for data acquisition, will make

it possible to perform many more experiments on the surface shielding effect.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0003, NUCLEAR MAGNETIC RESONANCE

A. Pines, University of California, Berkeley Campus, Lawrence Berkeley Lab., *Berkeley, California* 94720 (005941 TICNO; 4081)

New techniques are being developed to understand the interactions of nuclear spin with each other and with other degrees of freedom such as rotation and vibrations. This has led to new developments including multiple quantum spectroscopy and rotor-spin double resonance. The multiple quantum developments are important in other areas of physics and chemistry as well, leading to an understanding of coherent nonlinear processes, stochastic time-dependent evolution and selective excitation and detection in molecules. Applications, as with any new developments, are numerous. They include the study of static and dynamic properties of molecules in several phases of materials important to science and technology. For example, one can cite the recent contributions to amorphous solids, ferroelectric crystals, polymeric and liquid crystal phases, and fuel-related materials. Developments in spin-rotation interaction allow a determination of specific molecular excitations in crystals and observation of how these excitations transfer to other modes and ultimately relax incoherently into phonons.

BIBLIOGRAPHIC REFERENCES: Tang, J., A. Pines and S. Emid, Spin Lattice Relaxation of Reorienting or Tunneling Deuterated Methyl Groups, LBL-10162, 1979. Vega, S., T.W. Shattuck and A. Pines, Double Quantum Cross-Polarization NMR in Solids, LBL-10338, 1979.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0004, TURBULENT COMBUSTION

F. Robben, University of California, Berkeley Campus, Lawrence Berkeley Lab., *Berkeley, California* 94720 (005974 TICNO; 4765)

An experimental and computational investigation of some fairly fundamental aspects of turbulent combustion is being carried out. This work will aid in the development of numerical models of turbulent combustion which can be used in the design of efficient, low-pollution combustion systems. In the first task, a turbulent, heated wall boundary layer is being studied to determine the interaction of combustion heat release with the fluid mechanical turbulence. Comparison of the experimental results with single numerical computations is being carried out. In the second task, the interface between two fluids in a free-shear turbulent boundary layer is being studied. This problem is of fundamental importance to turbulent mixing controlled combustion, as the form of the turbulent eddies controls the rate of mixing of fuel and oxidizer. In the experimental portion the shear layer is created by merging two streams of water separated by a splitter plate. The roll-up and pairing of the interface is studied using hydrogen bubble and dye tracer techniques. The comparison numerical study will solve the two-dimensional Navier-Stokes equations for the vortex roll-up and pairing by extending a previously developed finite-difference technique. Comparison of the numerical computations with the experiment may lead to a significant advance in the understanding of the turbulent free-shear layer.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research

8.0005, EXPERIMENTAL STUDIES OF QUASI-ONE-DIMENSIONAL CRYSTALS

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Certain crystals (such as donor-acceptor complexes involving tetracyanoquinodimethane (TCNQ), and certain layered transition metal dichalcogenides) have electrical properties that are very much different in one direction from the other two. They are of interest because theoretical models for such quasi-1- or 2-dimensional systems are more readily solved than those for 3-dimensional. The small bandwidths, large electron-electron repulsions, and restricted dimensionalities make these materials ideal candidates for the study of several questions of basic physical interest. Thus, one-dimensional metals are intrinsically unstable against a metal in insulator transition. The effects of disorder and of impurities also are singular in one dimension, causing severe electron localization.

The present work involves a series of transport measurements (thermoelectric power, thermal conductivity, Hall effect) on several classes of these compounds (including charge transfer salts such as bis(tetrathiatetracene) triiodide and anisotropic metals such as niobium triselenide). The thermopower study is aimed at determining the role played by Coulomb correlations and phonon drag; the thermal conductivity and Hall effect studies are aimed at determining the nature of the charge carries involved. Some of these experiments may be performed in high electric fields to study nonlinear transport.

First year of three-year continuing grant; renewal of work supported by DMR76-83421.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0006, NUCLEAR MAGNETIC RESONANCE STUDIES OF MIXED-VALENT AND SUPERCONDUCTING RARE-EARTH COMPOUNDS

D.E. MacLaughlin, University of California, Riverside Campus, School of Natural & Agricultural Sciences, Dept. of Physics, *Riverside, California* 92502 (DMR78-10301)

A program of nuclear resonance and relaxation studies of rare-earth-based intermetallic compounds will be carried out. Two main areas of research are included. The first involves investigations of mixed-valent compounds, in which the occupation of the rare-earth 4f shell fluctuates randomly in time. Nuclear Magnetic Resonance shift measurements in such systems will yield information on the hyperfine field at the nuclear site, and thereby on the nature of the 4f wave function; and spin-lattice relaxation studies will provide a measure of the spin fluctuation times associated with valence mixing. Systems to be studied include nearly integral-valent compounds which exhibit Kondo behavior (CeA12, CeA13); alloys in which composition variations permit either mixed- or integral-valent behavior (CeIn3-xSnx); heavy rare-earth compounds with a wide range of characteristic energies (CeIn3-xSnx); heavy rare-earth compounds with a wide range of characteristic energies (YbAl2, YbAl3); and a system with high low-temperature resistivity (SmB6). The second research area involves studies of Nuclear Magnetic Resonance parameters in the recently discovered rare-earth rhodium boride ternary compounds. Information on the mutual interaction between superconductivity and magnetic order will be obtained, particularly on the effect of the superconducting transition on spin-spin interactions and critical behavior at the magnetic transition in ErRh4B4.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0007, STRUCTURE AND PHASE TRANSITIONS OF LIQUID CRYSTALS 16221-P

N.A. Clark, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Physics, *1200 University Ave., Boulder, Colorado* 80302 (DA0G9162; DAAG29-79-C-0174)

To advance the understanding of the phenomenology of liquid crystalline phases. Relevance - relevance of this work is manifold. The very large optical nonlinearities exhibited by liquid crystals make them candidates with high potential for applications to display and optical correlation currently being considered in MIRADCOM and ERADCOM laboratories.

The primary experimental techniques will be optical. Standard polarized microscopy will be used to examine a variety of liquid crystal structures. There will be a study of freely suspended liquid crystal films and the study of the macroscopic properties of smectics. Precision optical measurements of birefrin-

gence, optical activity, and reflectivity will be applied in order to characterize the response of the system.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0008, SUPERCONDUCTING AND NORMAL ELECTRICAL PROPERTIES OF ANISOTROPIC AND ION-IMPLANTED MATERIALS

W.C. Moulton, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Physics, *205 Wildwood Dr., Tallahassee, Florida* 32306 (DMR78-21612)

Research initiated under grant DMR 7610845 will be continued and extended. Although the proposed program represents a single research effort involving a study of strong-coupled superconductors, detailed investigations will be performed in three somewhat diverse areas: 1) the hexagonal tungsten bronzes, 2) the layered dichalcogenides, and 3) ion-implanted samples of transition metal elements and compounds. Work with the bronzes will emphasize materials preparation and measurements of electrical resistance, Hall coefficient and Seebeck voltages. The objective of this work is a detailed study of compositional and ion-size effects upon a suspected high-temperature phase transition and its relationship to the occurrence of high transition temperatures in these superconducting compounds. Studies concerned with the dichalcogenides and ion-implanted systems will concentrate on the effects which magnetic-ion additions have on the normal state and superconducting state properties of the host matrix. A newly commissioned vibrating magnetometer will provide additional data with regard to the magnetic state of these compounds. A superconducting solenoid will be used to extend studies of the field dependence of the Hall coefficient and magnetoresistance to magnetic field values as high as 5T. This work will yield essential data about the magnetic interactions occurring in these compounds and their effects upon the technologically important parameters of the superconducting state.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0009, COMPUTER EQUIPMENT TO STUDY ELECTRON-HOLE RECOMBINATION LUMINESCENCE IN REFRACTORY OXIDES

T.A. Lick, Stetson University, School of Liberal Arts, Dept. of Physics, *De Land, Florida* 32720 (CDP80-11464)

Electron-hole recombination luminescence resulting from tunneling will be studied in a series of refractory oxides: magnesia (MgO), spinel ($MgAl_2O_4$) and sapphire (Al_2O_3). The luminescence bands which have been observed in these three systems appear to result from electrons tunneling to holes trapped at cation vacancies (v centers). However, the electron traps are unknown, thus the tunneling mechanism is not understood. In a similar manner, MgO crystals coped with various transition element impurities will be studied.

Simultaneous resistivity measurements will be made in the second stage of investigation to determine which, if any, luminescence bands result from simple excitation of defects with no transport charge involved.

This award makes it possible to acquire a data acquisition and analysis system (microcomputer, plotter, etc.) for use in the research.

SUPPORTED BY U.S. National Science Foundation, Office of Planning & Resources Management, Div. of Budget & Program Analysis

8.0010, EXCITATION OF SOLIDS BY SYNCHROTRON RADIATION

F.C. Brown, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Physics, *106 Engineering Hall, Urbana, Illinois* 61801 (DMR79-13103)

Experimental research using the unique properties of synchrotron radiation to study inner shell excitations in solids will be carried out. The work will be carried out primarily at the Synchrotron Radiation Center, Stoughton, Wisconsin, where the new storage ring, Alladin, is being built. A beam line will be instrumental for producing intense monochromatic beams of photons with energies up to 2600 eV. This will be used to study radiation-induced defects and damage mechanisms in semiconductors and insulators. The emphasis will be on de-excitation processes including photolysis and color center production in insulators and radiation damage in semi-conductors.

This is a continuation of research previously supported by NSF grant DMR-7620644.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0011, PROPERTIES OF SOLIDS AND MANY-PARTICLE SYSTEMS

G.A. Baym, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (DMR78-21069)

Research previously supported by DMR7522241.

Theoretical research will be carried out on a number of topics: (1) Spin-glasses, including the question of the existence (or non-existence) of ordering in three dimensions and the adequacy of the Edwards-Anderson model. (2) Amorphous and random magnetic systems, in which percolation effects may be important. (3) Magnetic interfaces between domains in a ferromagnet. (4) Excitations in disordered systems, including the study of critical localization and mobility edges. (5) Liquid helium, which will involve the study of ion mobilities in superfluid He-3, mixtures of He-3 and He-4 and the hydrodynamic behavior of rotating He-4 superfluids. (6) Properties of matter at high densities, such as the investigation of pion condensation and the phase transition from nucleon matter to quark matter. (7) Dynamical behavior of neutron stars and supernovae.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0012, ACQUISITION OF INFRARED FLUORESCENCE APPARATUS

W. Christian, Earlham College, Graduate School, Dept. of Physics, *Richmond, Indiana* 47375 (CDP80-18627)

This award makes it possible to acquire an infrared fluorescence apparatus for research intended to lead to a clear understanding of energy transfer in nitrous oxide by measuring the rate constants for the transfer of energy from vibration to vibration and vibration to translation-rotation. The temperature-dependence of the rate constants will be compared with theory to determine the effect of the attractive part of the molecular potential for collisions between nitrous oxide and the noble gases and between nitrous oxide and the hydrogen halides.

In addition to providing new and useful data for nitrous oxide this research will test some of the fundamental assumptions of photoacoustic spectroscopy under low pressure conditions and may extend the useful range of quantitative photoacoustic spectroscopy.

SUPPORTED BY U.S. National Science Foundation, Office of Planning & Resources Management, Div. of Budget & Program Analysis

8.0013, SPECTROSCOPY OF THERMAL ENERGY TRANSPORT 16869-P

W.E. Bron, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Physics, *Memorial Hall, Bloomington, Indiana* 47401 (DA0G2312; DAAG29-80-C-0085)

To study the interaction of laser light with solids and phonon-based thermal energy transport. Relevance - the techniques and results are important to a number of technologies including thermal transport, the effect of laser light on solids, solar absorbers, heat conduction in microelectronics, and acoustic delay lines.

Direct observations are to be carried out on the frequency-dependence and interaction strengths of anharmonic processes

using vibronic sideband spectroscopy and coherent phonon generation through piezoelectric surface excitation with laser light. The investigation is to include resolution of the effects of competing interaction modes on measurements of phonon lifetimes, an account of crystal anisotropies and a determination of phonon lifetimes over phonon frequencies in the range from 1 to 10 THz.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0014, FABRICATION AND PROPERTIES OF ONE-DIMENSIONAL SYSTEMS
N.J. Giordano, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (DMR79-06716)

An experimental program to study the properties of several different types of one-dimensional systems will be carried out. This work falls into two main categories. (1) The electrical properties of random one-dimensional systems will be studied to provide a detailed, quantitative test of recent theoretical predictions that Anderson localization should be observable in these systems. (2) A new type of superconducting point contact, the first in which the geometry of the contact region is under direct experimental control and its nature well-characterized, will be investigated. This will allow a more detailed study of the physics of these devices than has been possible with point contacts of conventional design. Moreover, these point contacts should have good mechanical and thermal stability, making them prime candidates for a number of practical applications.

In order to make the samples required for these experiments, several new techniques for fabricating ultra-small structures will be developed. These techniques will not be limited to applications described above, but should also prove useful in many other microfabrication problems.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0015, FAR INFARED PROPERTIES OF SEMIMETALS AND DEGENERATE SEMICONDUCTORS
H.D. Drew, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics, *College Park, Maryland* 20742 (DMR77-28399)

Far infrared optical and magnetooptical studies of semimetals and semiconductors previously supported by NSF grant DMR-7302398 A03 will be continued. Primary emphasis will be on the determination of final state interaction effects in cyclotron resonance transitions in degenerate semiconductors.

The study of the magnetooptical properties of graphite in the far infrared will be completed. The planned measurements at several additional frequencies should provide useful band structure information and possibly evidence for electron-electron interaction effects. A program will be initiated to investigate the optical properties of BiSb alloys. The electron-electron interaction effects will be studied as a function of the carrier density. Also, an optically pumped far infrared laser will be constructed for use in these experiments. This laser will also be used for the study of energy gaps in such systems as the excitonic insulator energy state in BiSb alloys and the charge density wave state in 6i inversion layers and layered compounds.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0016, ENERGETIC PROTON DELAY FROM SOLAR RADIO BURSTS
P.M. Bakshi, Boston College, Chestnut Hill Campus, School of Arts & Sciences, Dept. of Physics, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DF583490; F19628-79-C-0084)

AF function - communication and surveillance. Deficiency -capability of accurately predicting time-of-arrival of solar flare emitted particles does not exist. Objective - to investigate the delay of solar flare energetic particles by means of associated solar radio burst observations. How research contributes - will provide a knowledge of the delay characteristics of energetic solar flare particles to establish prediction techniques for the incidence of solar-related disruptive influences on HF communications, OTH radars, and satellite communication systems.

The correlation between solar radio bursts and the propagation of energetic particles from the sun to the earth will be studied by consideration of such parameters as the burst peak radio flux spectral width (W3/W2), the time development of the radio burst spectral shape, the flare/burst position on the sun, the flare/burst flash phase rise-time, and the particle pitch angle distribution.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

8.0017, FUNDAMENTAL PROPERTIES OF SUPERCONDUCTORS
W.J. Skocpol, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Engineering & Applied Physics, *Cambridge Station, Cambridge, Massachusetts* 02138 (DMR79-04155)

The proposed research is a continuation and extension of work supported under NSF Grant No. DMR-7611323; it is a broad program encompassing experimental and theoretical studies with emphasis on nonequilibrium superconductivity. Studies of the relaxation rate of quasiparticle charge in superconducting microstrips will be extended to other geometries. This will permit the use of magnetic field to control the coupling between two or more superconducting phase-slip centers or Josephson junctions. Work on disequilibrium induced by far-IR and optical lasers will allow detailed study of the generation and relaxation of nonequilibrium quasiparticle population. Theoretical work will be carried out on the development of a theory of propagating damped branch-inbalance waves in superconductors. Theoretical and experimental studies of the dependence on anisotropy of the resistance in inhomogeneous systems near the percolation threshold will also be carried out.

First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0018, EXPERIMENTS ON THE NUCLEON-NUCLEON FORCE, PARTICULARLY PARITY VIOLATION
R. Wilson, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Physics, *Cambridge Station, Cambridge, Massachusetts* 02138 (PHY77-11115)

This grant is a continuation of work previously carried out under PHY77-11115A01. Work will be done on parity violation in nuclear forces. Work will be done at several different laboratories including Grenoble France and the National Bureau of Standards.

Specific experiments include d(n,gamma)t in which the asymmetry of the gamma with respect to the spin of the neutron will be measured. The reactions involving gamma rays are n plus d yields t gamma, 35Cl plus n yields 36Cl plus gamma, 56Fe plus n yields 57Fe plus gamma.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0019, ARCTIC DIGITAL SOUNDING
K. Bibl, University of Lowell, School of Pure & Applied Science, Dept. of Physics & Applied Physics, *Lowell, Massachusetts* 01854 (DF580560; F19628-78-C-0085)

AF function - communications and detection. Deficiency - prediction and real-time specification of the Arctic ionosphere. Objective -develop capability for automatic identification of 0 and X modes in ionograms. Develop capability for coarse angle-of-arrival measurements during ionosoundings. Conduct drift experiments to support auroral studies. Develop algorithms for the automatic reduction of selected ionospheric parameters from digital ionograms. Assess feasibility of hardware system to automatically read these parameters. Develop ionogram communica-

tor (ICOM) for the remote printing of Goose Bay ionograms in support of OTH backscatter radar tests. Refurbish Digisonde 128 for installation at KEFLAVIK NAS in support of OTH tests. Design sounding antenna, install sounder and train personnel in operation. Develop safeguards for 3 km telephone data link against lightning interference to electronic systems on either end. How research contributes - automatic real-time mode identification using polarized receiver antennas and the inherent capability of Digisonde for amplitude discrimination will improve present manual and planned automatic data reduction in support of AFGWC. Subsequent drift experiments will contribute to a study of the development of the mid-latitude F-layer trough. Results will directly support the OTH tests through improving the interpretation of Goose Bay ionograms availble at the test site. The Goose Bay ionospheric data are essential in the laboratory's research efforts to provide a model of the Arctic ionosphere for HF, especially OTH-propagation analysis. Automatic real-time data reduction will result in considerable cost-savings and decrease response-time of the environmental data acquisition.

An antenna switch controlled by the Digisonde will be constructed to select sequentially left- or right-handed circular polarization of the REC VE antenna system during ionogram sweeps. The Digisonde automatically labels echoes by amplitude comparison as 0 and X components. Steering of the receiver antenna beam will permit coarse angle-of-arrival determination of all returns to facilitate identification and clarification of oblique echoes. The Digisonde will further be used to conduct drift experiments interspersed in routine ionogram recording during ground-based/airborne F-layer trough studies. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

8.0020, STRUCTURE AND VIBRATIONAL EXCITATIONS OF INTERCALATED GRAPHITE 17641-P

S.A. Solin, Michigan State University, School of Natural Sciences, Dept. of Physics, *243 Natural Resources Bldg., East Lansing, Michigan* 48824 (DA0G2876; DAAG29-80-K-0003)

To develop a deeper understanding of the properties of intercalated graphite and other intercalated systems. Relevance - this research is directly relevant to the ongoing program on graphite intercalated systems that is being done at the University of Pennsylvania and MIT and it has direct relevance to questions related to high-conductivity graphite intercalation compounds.

Pure stage donor and acceptor compounds will be prepared with compositions spanning a broad range between concentrated stage 1 to dilute stage 9 systems. Special emphasis will be given to two-dimensional order-disorder transformations exhibited by graphite intercalates. The structure of the graphite will be studied using both X-ray diffraction and novel planar X-ray radial distribution analysis and extended X-ray absorption fine structure. Vibrational excitations will be studied primarily with Raman spectroscopic methods and with infrared spectroscopy in order to measure the modes of vibrations and test questions relating to nearest layer and zone-folding lattice vibration models. From the analysis of the Raman data as a function of donor and acceptor compounds, one may be able to answer fundamental questions about the degree of charge transfer and localization.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0021, A STUDY OF THE METAL-GaAs SCHOTTKY BARRIER

R.J. Bell, University of Missouri, Rolla Campus, School of Arts & Sciences, Dept. of Physics, *103 Parker Hall, Rolla, Missouri* 65401 (DF042610; AFOSR-76-2938)

AF function - microwave solid-state electronic devices are essential elements of Air Force surveillance, electronic countermeasures, and communication systems. Opportunity - the metal-GaAs Schottky barrier junction shows great promise for improving the performance of microwave devices for these systems. However, little is known about the metal-GaAs interface electronic states that produce the Schottky barrier. Objective - the objective of this research is to study the metal-GaAs interface electronic states. How work contributes -this research should provide additional knowledge on the physical nature of metal-GaAs interface electronic states that would indicate how these states could best be used in microwave devices.

The interface electronic states of thick metal layers on GaAs will be studied by optical absorption, internal photoelectric, capacitance-voltages, and electron energy loss techniques. Also, the role of oxygen at Schottky barrier junctions will be studied.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0022, MOLECULAR MODELS APPLIED TO HETEROGENEOUS NUCLEATION II (STUDIES OF WATER ON NUCLEATION SURFACES)

B.N. Hale, University of Missouri, Rolla Campus, School of Arts & Sciences, Dept. of Physics, *103 Parker Hall, Rolla, Missouri* 65401 (ATM77-12614)

This research will study the microphysical processes leading specifically to the nucleation of ice on substrates such as silver, iodide, graphite, silicates and ice. The intent is to understand the role of surface structure and chemical properties of artificial and natural ice nucleating agents. During the last two years, techniques which will use both quantum mechanics and effective pair potential treatments of the water-substrate interaction have been developed. This work will combine quantum mechanical calculations on small surface samples and effective pair potential calculations on semi-infinite and large finite substrates to develop a more realistic picture of the formation and growth of ice clusters on surfaces. The surface models will consist of atoms or molecules placed at the bulk lattice positions and surface irregularities such as vacancies, ledges, kinks, impurities (both ionic and neutral) and dislocations will be selectively incorporated into the top layers. Such an approach has the advantage of controlling the surface properties of the substrate - a major difficulty in experimental studies. These surface irregularities introduced into the model will be examined for their effect on absorbed water monomers and on the subsequent formation of ice clusters. Preliminary work is in progress and extensions to unrelaxed and relaxed surfaces of possible ice nucleants are outlined.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0023, CLOSED-CYCLE HELIUM LIQUEFACTION SYSTEM

D.J. Sellmyer, University of Nebraska, Lincoln Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *Lincoln, Nebraska* 68508 (DMR79-10802)

A closed-cycle helium liquefaction system will be installed at the University of Nebraska, Lincoln. This facility, which will be located in the Department of Physics and Astronomy, will also supply the liquid helium needs of the Chemistry and Electrical Engineering Departments. Personnel involved include ten faculty members, seven postdoctoral research assistants, and approximately fifteen graduate students. The areas of research are electronic and lattice properties of limited-dimensionality conductors, electronic structure of transition-metal and rare-earth compounds, electronic and magnetic states in metallic glasses, improper ferroelectricity and displacive phase transitions, and the synthesis, preparation and study of organometallic materials and molecular crystals. Initially the liquid helium usage is estimated to be 10,000 liters per year and it is anticipated that this facility will meet the future demands of Kansas State University, University of Kansas, University of Nebraska, at Omaha, University of Nebraska Medical Center and Wichita State University.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0024, SEMICONDUCTORS INVESTIGATED BY TIME-RESOLVED RAMAN, ABSORPTION AND PHOTOLUMINESCENCE SPECTROSCOPY

R.R. Alfano, City University of New York, City College, School of Liberal Arts & Sciences, Dept. of Physics, *Convent Ave. & 138th St., New York, New York* 10031 (DF057430; AFOSR-80-0079)

Microwave solid-state electronic devices are essential components of Air Force surveillance, electronic countermeasures and communications systems. Many electrical, optical and thermal properties of semiconductors are ultimately determined by the underlying physical phenomena produced by the interactions among and between electrons, phonons, excitons, plasmons, and other elementary excitations. Most microscopic processes involving these excitations occur on a picosecond time scale. The opportunity now exists to directly investigate relaxation kinetics in optical materials. Objective - to construct a femtosecond laser spectroscopy system and to study the underlying physical transient phenomena that occur in semiconductors and extract fundamental information on electron and phonon transport.

Picosecond and subpicosecond time-resolved spectroscopy and time-resolved Raman, absorption and photoluminescence will be used to investigate intervalley and intravalley scattering rates, thermalization rates, and the transient development of the electron distribution function of photogenerated carriers as function of temperature. The optical phonon lifetimes will be directly measured as a function of temperature.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0025, THE PHYSICS OF SPIN-POLARIZED ATOMIC VAPORS

W. Happer, Columbia University, Graduate School of Arts & Sciences, Dept. of Physics, *Broadway & W. 116th St., New York, New York* 10027 (DF038840; AFOSR-79-0082)

AF function - the AF has a requiremnt for long-term, low-drift space reference systems. Opportunity - development of optically pumped frequency standards, magnetometers, and gyroscopes will benefit from study of magnetic resonance in dense vapors where spin exchange equilibrium prevails. Objective - investigation of the properties of high-density, optically pumped alkali vapors and development of ways to make use of these vapors in miniature, inexpensive devices like magnetometers and gyroscopes. Contribution - cheaper and more rugged navigation, guidance, and control devices.

This research is directed toward development of ways to optically pump a very dense alkali vapor with a laser. Advantages are: the high light flux from the laser will allow much more sensitive and rapid measurements of magnetic resonance frequencies than is feasible with conventional optically pumped systems or with conventional nuclear magnetic resonance or electron spin resonance techniques, since gallium arsenide injection lasers are very small and potentially very inexpensive; a laser-pumped magnetic resonance device can be very small and cheap compared to conventional devices; the active volume of a device operating in the high density regime can be very much smaller than usual.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0026, THEORY OF CHARGE TRANSFER AT SEMICONDUCTOR-ELECTROLYTE INTERFACES

D. Mattis, Polytechnic Inst. of New York, Brooklyn Campus, School of Arts & Sciences, Dept. of Physics, *333 Jay St., Brooklyn, New York* 11201 (DN875508; N00014-78-C-0594)

Electrochemical processes at the semiconductor-electrolyte interface are important in many Navy areas of interest, including photolysis of water, photovoltaic devices, corrosion and techniques for surface passivation of semiconductors. Improved devices and better control of many problems associated with electrochemical processes of surfaces will result from better understanding of the mechanisms associated with charge transfer and current flow at these interfaces.

Theoretical techniques will be used to investigate the electron-hole recombination processes in bulk semiconductors and insulators and then extend the techniques to incorporate the effects due to defects in the bulk or due to surfaces and interfaces. Analysis will be made of surface stoichiometry in alloy materials such as oxides. Molecular field theory techniques will be used. The nature of the electronic states at the surface will be deduced.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0027, CALCULATIONS OF SURFACE BINDING AND MOBILITY OF ADATOMS 14766-MS

H.B. Huntington, Rensselaer Polytechnic Inst., School of Science, Dept. of Physics & Astronomy, *110 8th, Troy, New York* 12181 (DA0F9179; DAAG29-80-C-0130)

To theoretically approach the surface binding and mobility of adatoms, taking into account the metal surface structure, driving force for electromigration, and the influence of the adatoms on the electronic work function of the metal in order to achieve a simplified model of adatom-surface interactions. Relevance - catalysis, corrosion, oxidation, chemical vapor deposition on surfaces, and degradation of stability in printed circuit components of electronic equipment.

Investigation of the surface problem of simple, nearly free electron metals using the density functional formalism. Investigate the implications of the revised kinetic energy model on the binding energies of various metals of different charge densities. Study of the influence of close-packed and low-density planes. Calculations modeling situations of movement of impurity atoms across a surface, and electromigration along a free surface.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0028, NONCRYSTALLINE SOLIDS

D.G. Haase, University of North Carolina, North Carolina State University, School of Physical & Mathematical Sciences, Dept. of Physics, *Raleigh, North Carolina* 27607 (DN975200; N00014-79-C-0133)

Future naval systems for communication and information processing will utilize disordered solids, for which the theoretical understanding is presently inadequate. This work will address the problem of disordered solids.

A search will be made in hydrogen orientational glass for the low frequency or tunnel mode excitations previously observed only in structural glasses. In addition, models will be made and tested for the interface between a crystalline solid and a noncrystalline insulator.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0029, PROPERTIES OF ANISOTROPIC RELAXATION SEMICONDUCTORS

J.F. Schetzina, University of North Carolina, North Carolina State University, School of Physical & Mathematical Sciences, Dept. of Physics, *Raleigh, North Carolina* 27607 (DMR79-11336)

The structural, optical and photoelectric properties of cadmium telluride thin films will be investigated. A two-source deposition technique in an ultra-high vacuum chamber will be used to prepare hexagonal-phase CdTe layers. Films will be prepared with the vapor flow normal to the substrate and at an oblique angle of incidence. Preparation of double layer CdTe isojunctions will also be attempted. The structural properties of the layers will be studied using X-ray diffraction and electron microscopy facilities at North Carolina State University and at Oak Ridge National Laboratory. UV-visible-near IR reflectance and transmittance spectroscopy will be used to investigate the optical properties of the film samples. The photoelectric properties of these anisotropic layers will be measured using monochromatic radiation from a laser system in the wavelength range 400-700 nm. Photomagnetoelectric effect experiments will be performed to obtain values for excess carrier transport parameters. The effects of thermal and laser annealing on the structural, optical and photoelectric properties of the layers will also be investigated. The goal of this research is increased understand-

ing of the physics of anisotropic relaxation semiconductors, with hexagonal CdTe serving as a prototype material.

This is a continuation of research initiated under NSF Grant DMR77-08443A01. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0030, PHYSICAL PROPERTIES OF AMPHIPHILIC NEMATIC SYSTEMS

A. Saupe, Kent State University, Liquid Crystal Inst., Dept. of Physics, *Hilltop Dr., Kent, Ohio* 44240 (DMR79-07789)

Many important compounds in biological systems are amphiphilic. Surfactants, which are also amphiphiles, have widespread industrial and pharmaceutical applications. Better knowledge of amphiphile properties would thus help provide a basis for better understanding of biological processes, and for expanded applications. Amphiphilic nematic systems deserve special attention because their occurrence is of interest in itself, and because they provide an opportunity to study surfactants by methods which have not yet been explored.

The present research on amphiphilic systems which show certain nematic characteristics is designed to establish their physical properties and the range over which the properties can be varied. Viscous and elastic coefficients are determined as a function of temperature, water concentration, surfactant, type of counter ion, and additives. Refractive indices, diamagnetic susceptibilities, and nuclear magnetic resonance (NMR) spectra are measured to obtain structural information. The Cotton-Mouton effect is studied in isotropic micellar solutions of nematogenic systems to gain insight into micellar structures and interactions. Electrical conductivities also are measured to obtain indications of changes in micellar aggregation; they are of special interest near the nematic to lamellar smectic phase transition.

First year of a three-year continuing grant; renewal of work supported by DMR76-21363.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0031, NUCLEAR PHYSICS RESEARCH AT LOW & INTERMEDIATE ENERGIES

S.L. Blatt, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Physics, *164 W. 17th Ave., Columbus, Ohio* 43210 (PHY79-09157)

This is a continuation of research previously supported under grant PHY77-05021 A01. This grant will support a range of experiments in nuclear reactions, nuclear spectroscopy and related areas of nuclear science. The work will be carried out using a 7 MV Van de Graaff accelerator and at the University of Indiana Cyclotron. A special attribute of the Van de Graaff facility is the polarized ion source. Specific areas of research interest include polarization phenomena, properties of resonant nuclear states, radiative capture reactions, and intermediate energy reactions. Studies in atomic physics and nuclear astrophysics will be initiated.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0032, PHOTODISSOCIATION OF IONS OF ASTROPHYSICAL IMPORTANCE

J.T. Moseley, Oregon State Higher Education System, University of Oregon, School of Arts & Sciences, Dept. of Physics, *Johnson Hall, Eugene, Oregon* 97403 (AST79-18371)

An important part of understanding the interstellar medium is an understanding of the chemical processes involving various complex and exotic molecules. In recent years many of these molecules have been discovered. Yet the behavior of such molecules experimentally is poorly known, and in many cases the knowledge is completely lacking. The project to be carried out by Dr. Moseley at the University of Oregon is directed toward a series of laboratory determinations of the photodissociation parameters of several astrophysically interesting species. These include CHn ion (n equals 1 to 5), N2H ion, H3O ion, OH ion, HCO ion, and H2CO ion. Ultraviolet radiation in the wavelength range 10503 to 3500 Angstroms will be used from various laser and continuum sources. State-of-the-art laser techniques will be involved. The experimental information obtained will then be used to calculate the photodissociation rates, various branching possibilities, and lifetimes for the various ions of the molecular species in the conditions to be found in the interstellar medium.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

8.0033, ATOMIC INNER-SHELL PROCESSES 15208-P

B. Crasemann, Oregon State Higher Education System, University of Oregon, School of Liberal Arts, Dept. of Physics, *1472 Kincaid St., Eugene, Oregon* 97401 (DA0F9121; DAAG29-78-G-0010)

To study multiplet effects in Auger and fluorescence X-ray yields for multiply ionized atoms. Special attention will be paid for long-lived states with high fluorescence yields that may reduce the pumping power requirements in potential short-wavelength laser schemes. Relevance - this research is directly relevant to ongoing work at BRL on short-wavelength lasers, particularly high X-ray yields that can be due to multiplet effects. The elucidation of Auger transitions can lead to improved Auger spectroscopy which has been shown to have direct impact on such metallurgical problems as brittle fracture due to specific impurities at grain boundaries.

The investigator's new 'multiplet theory' will be used for this investigation. Relativistic multiconfiguration Hartree-Fock calculations of atomic binding energies will be performed and compared with experimental data.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0034, LIGHT SCATTERING IN FLUIDS

W.I. Goldburg, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics & Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (DMR80-15349)

The time evolution of a fluid mixture undergoing phase separation near the critical point will be studied. In one set of experiments the system will evolve from an unstable state (spinal decomposition). In the other, the fluid is prepared in metastable state, so that a thermodynamic barrier must be surmounted before phase separation proceeds by nucleation. Both processes will be monitored by light scattering and by direct microscope observation. The results will be compared with theoretical predictions.

Also to be studied is the electrical noise spectrum produced by critical binary mixtures through which a dc current is passed. Initial measurements show that composition fluctuations are the main source of noise near the critical point, and that far from this point a residual 1/f noise remains.

Finally light scattering will be used to study critical behavior in a binary mixture under shear flow.

This is the first year of a three-year continuing grant. This research was previously supported under NSF Grant DMR-7709910.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0035, SCATTERING OF SYNCHROTRON RADIATION

B.C. Larson, U.S. Dept. of Energy, Oak Ridge National Lab., *P.O. Box X, Oak Ridge Operations Office, Oak Ridge, Tennessee* 37830 (004177 TICNO; 00038(18))

The objective of this task is to extend the study of lattice dynamics and lattice statics of condensed matter to areas not feasible with conventional neutron and X-ray techniques, through the utilization of the National Synchrotron Light Source. The high collimation, high intensity, variable wave-

length, and small beam size associated with synchrotron radiation will open the possibility of studying lattice dynamics through the use of high-energy excitations, surface excitations, and atom specificity in multiatomic materials. The use of this facility for static lattice studies associated with atomic arrangements and displacements in alloys, interstitial impurities in metals, and defect clustering will lead to new and more quantitative information on the fundamental aspects of defects in crystals. Particular emphasis will be placed on the development of techniques that exploit the unique properties of the synchrotron source and that extend the present lattice dynamics and lattice defects investigations to a larger class of materials.

SUPPORTED BY U.S. Dept. of Energy, Office of Energy Research, Office of Basic Energy Sciences

8.0036, MAGNETIC PHASE TRANSITIONS AND GROUND-STATE PROPERTIES OF MAGNETIC CRYSTALS

J.L. Fry, University of Texas, Arlington Campus, Graduate School, Dept. of Physics, *Arlington, Texas* 76019 (DF043370; AFOSR-76-2981)

AF function - this proposed research primarily falls in the 7.4 research objectives which deal with the theoretical and experimental investigations of electronic, optical, acoustic, thermal, magnetic and conducting properties of materials to evolve new and improved device concepts. In particular, the theoretical investigations of the magnetic phase transitions will be done to give a deeper understanding of the physics of magnetic properties in itinerant electron systems. The gaining of this understanding of the precise mechanisms involved leads to meaningful mathematical models which in turn form a more rational and less empirical device design. Deficiency - a wide range of basic research efforts that support the development of devices and device concepts is needed for the application of contemporary electronic electromagnetic technology in the operational Air Force. Most studies of magnetic properties utilize model Hamiltonians and model potentials which leave a large amount of uncertainties. Objective - the major objective is to calculate from first principles magnetic systems including ground-state properties and phase transitions which occur with applied pressure or temperature changes. Also included are the magnetic excitations of these systems as well. Contribution - this research is a part of a comprehensive program in statistical mechanics to study phase transitions.

This proposal is to study magnetic crystals. The research includes studies of ground-state properties of magnetic crystals and the conditions which lead to magnetic phase transitions. This includes both temperature- and pressure-induced phase transitions. The stress in this study will be first principles, rather than phenomenological theories. In addition, a many-body theory which has been developed by the investigators will be programmed for the computer, applied to examine excitations of the magnetic system, and to obtain a more accurate theory of the magnetic phase transition temperatures.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0037, PHOTOACOUSTIC AND PHOTOTHERMAL SPECTROSCOPY OF IONS IN SOLIDS 16176-P

W.M. Yen, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Physics, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DA0G8996; DAAG29-79-C-0040)

Development and application of photoacoustic and photothermal spectroscopy to the study of impurity ions in crystalline and glassy solids. Relevance - relevant to the design of future rare earth ion laser and solid-state upconversion devices for mini-range finder applications.

Recent developments in photoacoustic and photothermal spectroscopy will be applied to the study of impurity ions in crystalline and glassy solids. Studies will include (1) measurements of quantum efficiencies and multiphonon relaxation of optical transitions, (2) intermodulation of photoacoustic signals for level isolation, and (3) photocooling effects.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0038, COSMIC RAY SHOWERS

K.E. Turver, University of Durham, Dept. of Physics, *South Rd., Durham, England, United Kingdom* (DA0D9345; DAERO 77 G0068)

To observe and study the atmospheric 'Cerenkov' radiation produced by cosmic ray showers.

To undertake field observations in the next several months on the range at Dugway Proving Ground, Dugway, Utah. This will be joint between the University of Durham and University of Utah.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, LABORATORY INVESTIGATION OF THE ORIGIN OF DIFFUSE INTERSTELLAR BANDS

T.J. Wdowiak, Miles College, Undergraduate School, *5500 Ave. G, Birmingham, Alabama* 35208 (RIM78-17825)

The research that will be done is to elucidate the origin of the diffuse interstellar bands by subjecting fused-ring organic compounds to temperatures in the range of 10 degrees to 100 degrees K and to ultraviolet radiation. The samples will be examined by absorption spectroscopy. Molecular structures to be investigated will include graphite precursor molecules and conjugated linear molecules thought to be good candidates for the constituents of interstellar dust. A free radical, free electron model fits many of the characteristics of diffuse interstellar bands and will be used as the rationale for the experiments.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0002, RADIO OBSERVATIONS OF THE SUN AT CENTIMETER AND MILLIMETER WAVELENGTHS

H. Zirin, California Inst. of Technology, Graduate School, Dept. of Astrophysics, *1201 E. California Blvd., Pasadena, California* 91109 (ATM79-06345)

This grant will support a program of research in solar radio astronomy at cm and mm wavelengths. The objectives are the determination of the properties of high energy electrons in solar flares and active regions, and to understand the radio emission of the quiet sun at cm and mm wavelengths. Interferometeric observations at Owens Valley Radio Observatory (OVRO) and the Very Large Array (VLA) will provide high spatial and time resolutions (0.1 sec and 4.6 arcsec at OVRO; 10 sec and better than 1 arcsec at the VLA). Cooperative observations with other radio observatories will also be undertaken. The specific programs listed are: (1) Analysis of data already in hand from a VLA run on flares, and several cooperative, multifrequency runs on flares, involving determination of the location and spatial distribution of the radio sources as a function of time, and compared with the active region magnetic fields. (2) New flare observations with 0.1 sec time resolution at OVRO. (3) Joint observation programs at different frequencies, including collaboration with the Flare Build-up study, the Solar Maximum Year and the SMM project. (4) Reduction of data expected to be obtained on the February 1979 eclipse. (5) VLA observations of solar flares. (6) Observations of the solar brightness distribution at 1.3 mm with the OVRO 10 meter mm dish. (7) Exploration

of the solar atmosphere by solar occultation of radio sources at cm wavelengths.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0003, ANALYSIS OF TIME-DEPENDENT H-ALPHA FLARE SPECTRA

J.L. Kulander, Lockheed Missiles & Space Co. Inc., *3251 Hanover St., Palo Alto, California* 94304 (ATM78-06276)

Perhaps the most extensive set of hydrogen-alpha line profiles from solar flares ever taken was obtained at the Lockheed Solar Observatory from 1972 to 1974. A large number of flare events were observed in their entirety, both near the center of the solar disc and near the limb at 15-second intervals.

The observed line profiles are highly asymmetric due primarily to the large velocities present in the flare. This grant will support a study to determine the velocity and other physical parameters as a function of time at different positions within flares and for several types of flares. This will be done by generating theoretical line profiles to compare with the observed profiles.

The velocity profiles derived from the data will be compared with those predicted by various theoretical flare models in an effort to determine the appropriate flare mechanism. Electron temperatures and flare optical thicknesses will also be used to select a flare model.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0004, A THEORETICAL INVESTIGATION OF THE COMPOSITION AND STRUCTURE OF COMETS

D.A. Mendis, University of California, San Diego Campus, Graduate School, Dept. of Applied Physics & Information Science, *P.O. Box 109, La Jolla, California* 92037 (AST78-19008)

Comets are considered to be the most primitive and least evolved members of the solar system in many respects. Research on these objects thus bears on the origin and evolution of the solar system. In this project, information of use to researchers in the interstellar medium should also be obtained. The aim of this project is to investigate theoretically the structure and composition of comets. The five principal areas to be studied are: 1. The physical and dynamical processes in the gases surrounding the comet, its atmosphere, ionosphere, and tail. 2. The interactions between comets and the solar wind. 3. The formation and shapes of cometary magnetic fields and the associated currents and plasma flow. 4. Physical properties of the nucleus and dust components, including their probable chemical compositions. 5. The interactions between cometary dust and plasma, particularly in the dust tails associated with some comets.

Prior support was by NSF grant AST 77-19879.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0005, HIGH RESOLUTION STUDIES OF SOLAR ACTIVE REGIONS, FLARES AND PROMINENCES AT CENTIMETER AND MILLIMETER WAVELENGTHS

D. Kundu, University of Maryland, College Park Campus, School of Engineering, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (ATM78-21762)

This grant continues the use of existing large interferometers such as the Very Large Array (VLA), the Westerbork Synthesis Radio Telescope (WSRT), and the Mat Creek interferometer for making high resolution observations of solar active regions, flares and prominences at centimeter and millimeter wavelengths. It is intended to produce maps of active regions with high spatial resolution from observations over a period of 8-12 hours, using the VLA and the WSRT. These maps will provide information on the distribution of temperature (Te), (Ne) and magnetic fields in active regions. Comparison of these maps with X-ray maps to be obtained from the Solar Maximum Mission with a resolution of a few arc seconds which give Te and Ne fairly accurately, should lead to a better understanding of the generating mechanism of radio emissions from active regions and should result in a better estimate of coronal magnetic fields. It is also intended to study the increases in intensity and polarization in the active region core and identify them with specific features in soft X-rays, in order to understand better the flare build-up process. The spatial resolution will answer the question of whether in a complex region the flaring kernel is the one that undergoes pre-heating.

The radio data will permit an understanding of the mechanisms responsible for the release of energy during the impulsive phase and the acceleration of electrons, and to determine the site of electron acceleration. In combination with hard X-ray data to be obtained from SMM they will also permit critical examination of the existing flare theories and X-ray flare models with particular reference to the magnetic field configuration.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0006, IONOSPHERIC VARIABILITY

M.J. Mendillo, Boston University, School of Liberal Arts, Dept. of Astronomy, *755 Commonwealth Ave., Charles River Campus, Boston, Massachusetts* 02215 (DF249900; F19628-77-C-0270)

AF function - radio frequency ranging systems for navigation and satellite detection and tracking. Deficiency - monthly average models are available for correcting for the effects of the earth's ionosphere on the velocity of radio waves. However, on a day-to-day basis, the models have errors of up to 25 percent rms. The effect on the ionosphere of large magnetic storms has been studied, and can be corrected for to first order. Other variations occur which are not yet understood and which cause large errors from average conditions. Objective - study the day-to-day variability of the ionospheric f region to develop algorithms to improve models of ionospheric time delay. How research contributes -results will improve existing models of the time delay to operational radar and navigation systems, and will require the use of fewer monitoring stations to update ionospheric conditions.

The ionosphere has an approximate 25 percent variability from monthly average conditions. The contractual approach to study this variability will be to find relationships with other geophysical parameters which correlate with ionospheric parameters such as total electron content and Nmax after the effects of magnetic storms have been carefully removed from the data. Also, power spectral analyses will be done to determine the predominant spectral features of the temporal behavior and its repeatability. Some model studies will be undertaken to determine the effects of changes in neutral winds, electric fields and auroral heating on the day-to-day variability of the f region.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

10.0007, SOLAR-STELLAR STUDY

L.W. Ramsey, Pennsylvania State University, University Park Campus, School of Science, Dept. of Astronomy, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (DF583950; F19628-80-C-0036)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate warnings of sun-induced disruptions of AF communications and detection systems. Objective - provide long-term forecasts of solar activity levels and new data on solar-type processes under extreme conditions. How research contributes - improve knowledge of the behavior of the solar activity cycle, enabling the general level of activity to be predicted years in advance. Such capability would allow long-term planning for fabrication of communication and detection equipment.

Stellar chromospheric activities will be correlated with observable parameters which have solar counterparts, thus providing a better understanding of the solar activity cycle.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

10.0008, THE CHEMICAL COMPOSITION OF STARS

D.L. Lambert, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (F-634)

Experimental tests of theories of chemical element synthesis in stellar interiors have been conducted with high quality stellar spectra obtained at the W.J. McDonald Observatory.

Elements heavier than iron are synthesized in a stellar interior by a stepwise capture of slow neutrons on iron group nuclei. The 22Ne (alpha,n) 25Mg reaction has been suggested as the neutron source. Analysis of TiO and MgH absorption bands in spectra of several stars showing high concentrations of the heavy elements produced by neutron capture has shown no enhancement of the 50Ti, 25Mg abundances. If the 22Ne reaction is the neutron source, substantial enhancements are predicted for those three isotopes. Clearly, the new spectroscopic result eliminates the 22Ne reaction. Indirect evidence points to the alternative 13C (alpha,n) 16O reaction.

Elements between O and Fe are produced by explosive nucleosynthesis. In explosive carbon burning, production of the non-alpha nuclei is predicted to be very sensitive to the initial abundance of CNO nuclei. Spectra of MgH lines in a metal-poor star show clear evidence for a deficiency of 25Mg and 26Mg relative to the pure-alpha nucleus 24Mg. This new result is in qualitative agreement with predictions for explosive C burning.

SUPPORTED BY Robert A. Welch Foundation

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01 AERONAUTICS (GENERAL)

N81-24019* National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 134
Apr. 1981 76 p
(NASA-SP-7037(134)) Avail: NTIS HC $5.00 CSCL 01A

This bibliography lists 387 reports, articles, and other documents introduced into the NASA scientific and technical information system in March 1981. Author

N81-24020# Aeronautical Systems Div., Wright-Patterson AFB, Ohio. Directorate of Equipment Engineering.
AERONAUTICAL SYSTEMS TECHNOLOGY NEEDS: ESCAPE, RESCUE AND SURVIVAL AND TEST FACILITIES AND TEST EQUIPMENT Annual Report
Clifton J. Miller Feb. 1981 94 p Supersedes ASD-TR-80-5010, ASD-TR-80-5011
(AD-A097827; ASD-TR-81-5008; ASD-TR-80-5010; ASD-TR-80-5011) Avail: NTIS HC A05/MF A01 CSCL 01/3

This report is a part of a compilation of formalized Technology Needs covering Equipment Subsystems as identified in the Aeronautical Systems Division. They are based on development/operational experience, systems studies and new concepts - all related to future system applications. Their presentation is to serve threefold purpose; i.e., guidance for technology program, proven developmental potential, and engineering data/requirements essential for technology use in systems. The identified needs delineate progress desired in performance, control, design flexibility, safety and cost. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N81-24021*# Neilsen Engineering and Research, Inc., Mountain View, Calif.
AN IMPLICIT METHOD FOR THE CALCULATION OF INLET FLOW FIELDS Progress Report, 12 Sep. 1979 - 30 Nov. 1980
Sedat Biringen and O. J. McMillan Washington NASA Jun. 1981 48 p refs
(Contract NAS1-15951)
(NASA-CR-3413; NEAR-TR-232) Avail: NTIS HC A03/MF A01 CSCL 01A

Inlet flow fields are calculated by an implicit, time marching procedure to solve the thin layer Navier-Stokes equations formulated in body fitted coordinates. Because the method can be used for a flow field with both subsonic and supersonic regions, it is applicable to subcritical as well as supercritical inlet operation. Results are presented and discussed for an inlet of current design practice. Results include inviscid calculations performed for supercritical inlet operation with uniform and nonuniform inflow boundary conditions as well as for subcritical inlet operation with uniform inflow boundary conditions. Results for viscous calculations performed for supercritical inlet operation with uniform inflow boundary conditions are also discussed. Author

N81-24022*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DESIGN AND EXPERIMENTAL RESULTS FOR A NATURAL-LAMINAR-FLOW AIRFOIL FOR GENERAL AVIATION APPLICATIONS
Dan M. Somers Jun. 1981 104 p refs
(NASA-TP-1861; L-14117) Avail: NTIS HC A06/MF A01 CSCL 01A

A natural-laminar-flow airfoil for general aviation applications, the NLF(1)-0416, was designed and analyzed theoretically and verified experimentally in the Langley Low-Turbulence Pressure Tunnel. The basic objective of combining the high maximum lift of the NASA low-speed airfoils with the low cruise drag of the NACA 6-series airfoils was achieved. The safety requirement that the maximum lift coefficient not be significantly affected with transition fixed near the leading edge was also met. Comparisons of the theoretical and experimental results show excellent agreement. Comparisons with other airfoils, both laminar flow and turbulent flow, confirm the achievement of the basic objective. Author

N81-24023*# Boeing Vertol Co., Philadelphia, Pa.
FLAP SURVEY TEST OF A COMBINED SURFACE BLOWING MODEL: FLOW MEASUREMENTS AT STATIC FLOW CONDITIONS
Toshiyuki Fukushima Mar. 1978 64 p refs
(Contract NAS2-9693)
(NASA-CR-152124) Avail: NTIS HC A04/MF A01 CSCL 01A

The Combined Surface Blowing (CSB) V/STOL lift/propulsion system consists of a blown flap system which deflects the exhaust from a turbojet engine over a system of flaps deployed at the trailing edge of the wing. Flow measurements consisting of velocity measurements using split film probes and total measure surveys using a miniature Kiel probe were made at control stations along the flap systems at two spanwise stations, the centerline of the nozzle and 60 percent of the nozzle span outboard of the centerline. Surface pressure measurements were made in the wing cove and the upper surface of the first flap element. The test showed a significant flow separation in the wing cove. The extent of the separation is so large that the flow into the first flap takes place only at the leading edge of the flap. The velocity profile measurements indicate that large spanwise (3 dimensional) flow may exist. T.M.

N81-24024*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
DEVELOPMENT OF A NONLINEAR VORTEX METHOD Progress Report, 1 Oct. 1980 - 31 Mar. 1981
Osama A. Kandil May 1981 33 p refs
(Grant NsG-1560)
(NASA-CR-164351) Avail: NTIS HC A03/MF A01 CSCL 01A

Progress is reported in the development of reliable nonlinear vortex methods for predicting the steady and unsteady aerodynamic loads of highly sweptback wings at large angles of attack. Abstracts of the papers, talks, and theses produced through this research are included. The modified nonlinear discrete vortex method and the nonlinear hybrid vortex method are highlighted. A.R.H.

N81-24025*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AERODYNAMICS, AEROELASTICITY, AND STABILITY OF HANG GLIDERS. EXPERIMENTAL RESULTS
Ilan M. Kroo Apr. 1981 109 p refs Prepared in cooperation with Stanford Univ.
(NASA-TM-81269) Avail: NTIS HC A06/MF A01 CSCL 01A

One-fifth-scale models of three basic ultralight glider designs were constructed to simulate the elastic properties of full scale gliders and were tested at Reynolds numbers close to full scale values. Twenty-four minor modifications were made to the basic configurations in order to evaluate the effects of twist, reflex, dihedral, and various stability enhancement devices. Longitudinal and lateral data were obtained at several speeds through an angle of attack range of -30 deg to +45 deg with sideslip angles of up to 20 deg. The importance of vertical center of gravity displacement is discussed. Lateral data indicate that effective dihedral is lost at low angles of attack for nearly all of the configurations tested. Drag data suggest that lift-dependent viscous drag is a large part of the glider's total drag as is expected for thin, cambered sections at these relatively low Reynolds numbers. A.R.H.

N81-24026*# Kansas Univ., Lawrence.
COMPARISON OF SELECTED LIFT AND SIDESLIP CHARACTERISTICS OF THE AYRES THRUSH S2R-800, WINGLETS OFF AND WINGLETS ON, TO FULL-SCALE WIND-TUNNEL DATA
J. Roskam and M. Williams Apr. 1981 118 p refs
(Grant NsG-1574)
(NASA-CR-165710; KU-FRL-399-3) Avail: NTIS HC A06/MF A01 CSCL 01A

All calculations were done in the stability axes system. The winglets used were constructed of modified GA(w)-2 airfoils. Aerodynamic characteristics discussed include: angle of attack; lift-curve slope; side force; yawing moments; rolling moments. S.F.

N81-24027# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
DYNAMICS OF TURBULENT VORTEX RINGS Final Report, 1 May 1978 - 30 Apr. 1980
Bradford Sturtevant 31 Jan. 1981 31 p refs
(Contract F49620-77-C-0107; AF Proj. 2307)
(AD-A098111; GALCIT-134-(B); AFOSR-81-0400TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

One of the major challenges facing engineers who deal with complicated flow systems is the question of how to analyze flow fields containing complex distributions of vorticity. Such flow fields occur in boundary layers and other shear flows and also in applications where mixing is a prime consideration, such as in combustors, chemical lasers, etc. It is often necessary to know something about the scale and geometry of the flow field, in addition to the mixing and transport. Unfortunately, vortex interactions are inherently long range and no local theory can yield the geometry of the flow or the distribution of the vorticity at any given location. Consequently, there is presently no approximate theory for treating vortex flows of complicated geometry. In order to provide information about the processes that are important in vortex flows, and to provide guidance for the development of theoretical models of these flows, it is important that experiments exploring the fundamental behavior of simple vortex flows be carried out. GRA

N81-24028# General Dynamics Corp., Fort Worth, Tex. Aerospace Technology Dept.
FOUNTAIN-JET TURBULENCE Final Report, 1 Oct. 1979 - 30 Sep. 1980
William H. Foley and Dennis B. Finlay Sep. 1980 21 p refs
(Contract F49620-80-C-0003; AF Proj. 2307)
(AD-A098098; AFOSR-81-0286TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

A series of experiments was conducted on a model to investigate the characteristics of fountain jets that develop beneath hovering VSTOL aircraft. The results confirm the results of previous studies in that normally developing fountains possess abnormally high turbulence levels that can be reduced by the presence of trip devices placed along the fountain stagnation line. The present work shows that fountain turbulence is highly anisotropic with the intensity of the streamwise component in order of magnitude greater than the cross component. Further, the anamoly appears to occur only in fountains produced by jets of air that strike normal to the ground surface; jets that strike at angles other than the perpendicular do not appear to generate highly turbulent fountains. Author (GRA)

N81-24029# Ballistic Research Labs., Aberdeen Proving Ground, Md.
MC DRAG: A COMPUTER PROGRAM FOR ESTIMATING THE DRAG COEFFICIENTS OF PROJECTILES Final Report
Robert L. McCoy Feb. 1981 74 p refs
(DA Proj. 1L1-62618-AH-80)
(AD-A098110; AD-E430592; ARBRL-TR-02293) Avail: NTIS HC A04/MF A01 CSCL 20/4

This report presents a FORTRAN program 'MC DRAG' for estimating a projectile's zero-yaw drag coefficient from the given values of certain size and shape parameters. The results are valid over a Mach number range of 0.5 to 5 and a projectile diameter range of 4 to 400 millimeters. A user's guide and a FORTRAN listing of MC DRAG is provided. The program is applied to three illustrative examples: (1) an experimental low-drag small arms bullet, the 5.56mm BRL-1 design; (2) a 55mm scale model of the Minuteman re-entry stage vehicle; (3) the 155mm long-range artillery shell M549. The MC DRAG program estimates drag coefficient to within 3% error at supersonic speeds, 11% error at transonic speeds, and 6% error at subsonic speeds. GRA

N81-24030# Calspan Advanced Technology Center, Buffalo, N.Y. Advanced Technology Center.
BOUNDARY LAYER TRANSITION AND SURFACE ROUGHNESS EFFECTS IN HYPERSONIC FLOW Annual Technical Report, 1 Nov. 1979 - 1 Nov. 1980
Michael S. Holden Feb. 1981 45 p refs
(Contract F49620-79-C-0003; AF Proj. 2307)
(AD-A098122; CALSPAN-6430-A-1; AFOSR-81-0399TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

Experimental studies are being conducted to examine the stagnation region heating in transitional flow over blunt nose tips; and the effects of surface roughness on the heat transfer and skin friction to hypersonic re-entry vehicles. Measurements have been made of the distribution of heat transfer and skin friction over sharp and blunted cones to a range of incidences for surface roughness of 0, 10 and 15 mils. These studies have been conducted at a local Mach number of 11.7 and Reynolds numbers based on model length of 30 x million, giving roughness Reynolds numbers from transitional to fully rough over the models. New calorimeter and thin film instrumentation was developed expressly for the rough wall heating measurements. The measurements indicated that while the roughness-induced augmentations in heat transfer and skin friction were less than would be predicted using theories based on low speed data for low R sub k's, close to the nose tip significantly larger augmentation factors were observed. The current studies suggest that significant compressibility effects may be present in hypersonic turbulent boundary layers over rough walls. The models and highly detailed heat transfer and pressure instrumentation have been completed for the stagnation point heating studies. A new and novel throat valve has been developed to eliminate the

frangible mylar diaphragm which can cause particles and disturbances during flow establishment in the shock tunnel. The experimental studies are now in progress. Author (GRA)

N81-24031# Aeronautical Research Labs., Melbourne (Australia).
TRANSONIC WIND TUNNEL MEASUREMENTS OF TAILPLANE AND ELEVATOR EFFECTIVENESS OF THE JINDIVIK 203B TARGET AIRCRAFT
B. D. Fairlie Sep. 1980 89 p refs
(AD-A098180; ARL/AERO-NOTE-400) Avail: NTIS HC A05/MF A01 CSCL 20/4

Measurements of tailplane and elevator effectiveness are reported for a 1/20th scale complete model of the Jindivik target aircraft. The model reflected the Mk.203B version of the full scale aircraft, the major features of which are as follows: short wing with Mk.8 fuel pods (with fins), nominal - 1 deg twisted flap, fixed ailerons drooped at 1 - 1/2 deg.: extended chord tailplane with a nominal setting of -1/2 deg. The tests included tailplane angles in the range -2 and 1/2 deg. to 3 and 1/2 deg. and elevator angles in the range -15 deg. to 10 deg. for Mach numbers between 0.5 and 0.9. The aircraft is shown to be generally stable throughout the tested ranges, but several small areas of instability are noted. Tailplane and elevator angles to trim are also included and both are shown to increase rapidly for Mach numbers above 0.75. Author (GRA)

N81-24032# Nielsen Engineering and Research, Inc., Mountain View, Calif.
EXPERIMENTAL RESULTS ON VORTICITY SHEDDING AT THE EDGE OF A FLAT PLATE IN TWO DIMENSIONAL FLOW Interim Technical Report, 1 May 1978 - 30 Mar. 1980
S. B. Spangler, R. G. Schwind, and K. Owen Sep. 1980 152 p refs
(Contract N00014-78-C-0388; RF41411801)
(AD-A098264; NEAR-TR-224) Avail: NTIS HC A08/MF A01 CSCL 20/4

A two dimensional test was performed on a flat plate normal to a low subsonic flow to investigate the relationship between the vorticity shed at an edge and the vorticity appearing in the shear layer adjacent to the edge. Both a sharp and rounded edge were provided on the plate. A splitter plate was used to create a steady wake flow behind the plate. The measurements made were velocities in the flow field, static pressures on the model upstream and downstream surfaces, and surface flow visualization. A laser velocimeter was used to obtain the velocity measurements. Analysis of the data was performed to calculate circulation and vorticity transport rate in the flow adjacent to the edge and vorticity transport rate of the flow separating from the edge. Author (GRA)

N81-24033# Argonne National Lab., Ill. Languages Services Dept.
EXPERIMENTAL ANALYSIS OF THE DYNAMIC LIFT ON A CYLINDER SUBJECTED TO HIGH REYNOLDS NUMBER FLOWS PERPENDICULAR TO ITS AXIS
H. Loiseau and E. Szechenyi Jan. 1981 27 p refs Transl. into ENGLISH from Rech. Aerosp. (France), no. 5, Sep. - Oct. 1972 p 279-291
(ANL-Trans-1192) Avail: NTIS HC A03/MF A01

A method of measuring dynamic lift by means of pressure transducers was developed and checked against the well known force transducer procedure. Apart from dynamic lift these measurements yield the circumferential and axial fluctuating pressure distribution. The axial dynamic lift variations and spatial cross-correlations were obtained by changing the relative positions of three separate sections of the cylinder, each equipped with pressure transducers. The results agree well with published figures when applicable and they also show clearly the complexity and randomness of the flow at transcritical Reynolds numbers. The axial space cross-correlations and coherence permit an approximate calculation of the total dynamic lift forces acting on the length of a cylinder and an estimation of their power spectra. It was found by means of flow visualizations that the surface condition of the cylinder is an important parameter, at least at transcritical Reynolds numbers. DOE

N81-24034# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
CIVIL COMPONENT PROGRAM WING SECTION. NEW CALCULATION METHODS FOR SUBSONIC AND TRANSONIC INTERFERENCE WITH PLANAR AND SPATIAL FLOWS Final Report
Heinz Jakob, Karl-Dieter Klevenhusen, and Hadwin Struck Bonn Bundesministerium fuer Forschung und Technologie Sep. 1980 121 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-80-022; ISSN-0170-1339) Avail: NTIS HC A06/MF A01

An appropriate hybrid procedure for modeling the flow field of supercritical wing designs is presented. A singularity method is developed which determines subsonic flow and streamline coordinates around multi-element airfoils. These coordinates are used to solve the transonic boundary value problem for multi-element configurations. The problem of evaluating planar flow is solved by a three dimensional panel method and a three dimensional difference method. As a practical example, calculations for the B10-2V wing (European AIRBUS) are detailed. Results demonstrate that the calculation method is well-formulated for revealing the influence of body or wing-engine configuration on the wing flow distribution. Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N81-24035*# Douglas Aircraft Co., Inc., Long Beach, Calif.
STUDY OF AIRCRAFT CRASHWORTHINESS FOR FIRE PROTECTION Final Report, 15 Apr. 1980 - 28 Feb. 1981
A. Cominsky Jan. 1981 127 p refs
(Contract NAS2-10583)
(NASA-CR-166159) Avail: NTIS HC A07/MF A01 CSCL 01C

Impact-survivable postcrash fire accidents were surveyed. The data base developed includes foreign and domestic accidents involving airlines and jet aircraft. The emphasis was placed on domestic accidents, airlines, and jet aircraft due principally to availability of information. Only transport category aircraft in commercial service designed under FAR Part 25 were considered. A matrix was prepared to show the relationships between the accident characteristics and the fire fatalities. Typical postcrash fire scenaries were identified. Safety concepts were developed for three engineering categories: cabin interiors - cabin subsystems; power plant - engines and fuel systems; and structural mechanics - primary and secondary structures. The parameters identified for concept evaluation are cost, effectiveness, and societal concerns. Three concepts were selected for design definition and cost and effectiveness analysis: improved fire-resistant seat materials; anti-misting kerosene; and additional cabin emergency exits. J.M.S.

N81-24036# Dayton Univ., Ohio.
VALIDATION OF A BIRD SUBSTITUTE FOR DEVELOPMENT AND QUALIFICATION OF AIRCRAFT TRANPARENCIES Final Technical Report, Jul. 1979 - Jul. 1980
Antonios Challita Wright-Patterson AFB, Ohio Air Force Wright Aeronautical Labs. Oct. 1980 74 p
(Contract F33615-78-C-3402; AF Proj. 2402)
(AD-A097736; UDR-TR-80-69) Avail: NTIS HC A04/MF A01 CSCL 01/3

This report describes an experimental study designed to validate a substitute bird for development and qualification of aircraft transparencies. For a substitute bird to be accepted by the transparency community it has to generate the same impact loads as real birds and damage the transparency in the same manner. Nominal 450 g real and spherical substitute birds were launched onto 0.635 cm thick polycarbonate panels at four different locations. The minimum perforation velocity was used

as the main criterion to measure damage; however, perforation wasn't achieved at the center panel and at the lower, or upstream, corner. Therefore, other measures of damage were adopted for these locations; length of cracks, depth of pocket, etc. Also, temporal and spatial distribution of loads were measured for 60 and 600 g spherical substitute birds at three impact angles (90 deg, 45 deg, and 25 deg) and three velocities (100, 200, 300 m/s). Time pressure traces recorded in this program showed a rise and decay of a shock pressure; no steady state flow was observed. GRA

N81-24037# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
MPES NEGATIVE G RESTRAINT STRAP DESIGN OPTIONS
Thomas J. Zenobi Feb. 1981 11 p
(AD-A098030; NADC-80232-60) Avail: NTIS HC A02/MF A01 CSCL 01/3

Preliminary investigation shows that the negative G restraint configurations are viable design approaches. The restraint systems will be fabricated and incorporated into MPES. Human subjects will be used for evaluation of the negative G restraint. Areas of concern which will be studied are: crewman comfort; ease of donning/adjusting the restraint, and restraint release for man/seat separation. For measuring effectiveness of the restraint under the negative G environment, the seat/man configuration will be suspended upside-down (simulating a -1G environment) and measurements and observations will be noted. The NADC centrifuge also looms as a possible test bed for testing the negative G restraint under a variety of negative G profiles. GRA

N81-24038# Federal Aviation Administration, Washington, D.C. Office of Aviation Safety.
SUMMARY OF FEDERAL AVIATION ADMINISTRATION RESPONSE TO NATIONAL TRANSPORTATION SAFETY BOARD SAFETY RECOMMENDATIONS Quarterly Report, Jul. - Sep. 1980
J. R. Harrison Oct. 1980 254 p
(AD-A098096; FAA-ASF-81-1) Avail: NTIS HC A12/MF A01 CSCL 01/2

This report contains NTSB recommendations and all FAA responses to Board recommendations that were delivered to the Board during the applicable quarter. In addition, the report includes NTSB requests and FAA responses concerning reconsiderations, status reports, and followup actions. The Table of Contents for this report reflects only those NTSB recommendations which are still open pending FAA action (i.e., those that have not been designated as 'Closed' by the NTSB as a result of acceptable action). Accordingly, the Table of Contents may reflect a number of multiple recommendations (example: A-80-27 through 29), but background material is included only for those recommendations which remain in an 'Open' status. Background information for those recommendations which have been closed is available in FAA headquarters files. Author (GRA)

N81-24039# Federal Aviation Administration, Atlantic City, N.J. Technical Center.
EFFECT OF THERMAL RADIATION ON THE INTEGRITY PRESSURIZED AIRCRAFT EVACUATION SLIDES AND SLIDE MATERIALS Final Report, May 1979 - Sep. 1980
Louis J. Brown, Jr. and Eldon B. Nicholas Mar. 1981 79 p refs
(FAA Proj. 181-350-320)
(AD-A098179; FAA-CT-81-28) Avail: NTIS HC A05/MF A01 CSCL 01/2

Seventeen full-scale fire tests were conducted to examine the effect of thermal radiation from a large fuel fire on the integrity of pressurized aircraft evacuation slides. Urethane nylon, aluminized urethane nylon, neoprene nylon, aluminized neoprene nylon, and aluminized neoprene Kevlar slides were tested at various distances from a 30- by 30-foot fire pit. Heat flux at the slide, inflation pressure, and air temperature were measured and motion pictures and photographs were taken during these full-scale tests. At an average heat flux level of 1.5 Btu/sq ft-second (sec) (15 feet from edge of fire pit) inservice evacuation slides failed in a nonseam area in 23 to 32 seconds. With an aluminized coating applied to the airholding surfaces, the time failure increased by more than a factor of two at the same test condition. A laboratory test method, suitable for materials qualification, was developed that exposes an evacuation slide material to a preselected radiant heat flux and pressure. Tests were conducted on new materials submitted by slide and material manufacturers, and material samples taken from the undamaged areas of full-scale test slides. A good correlation was demonstrated between the failure times measured in full-scale and laboratory tests. Author (GRA)

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N81-24040*# Bendix Corp., Teterboro, N. J. Flight Systems Div.
COCKPIT SIMULATION STUDY OF USE OF FLIGHT PATH ANGLE FOR INSTRUMENT APPROACHES Final Report, Mar. - Nov. 1980
B. Hanisch, H. Ernst, and R. Johnston May 1981 57 p refs
(Contract NAS1-16144)
(NASA-CR-165708; FSD-7511-81-06) Avail: NTIS HC A04/MF A01 CSCL 17G

The results of a piloted simulation experiment to evaluate the effect of integrating flight path angle information into a typical transport electronic attitude director indicator display format for flight director instrument landing system approaches are presented. Three electronic display formats are evaluated during 3 deg straight-in approaches with wind shear and turbulence conditions. Flight path tracking data and pilot subjective comments are analyzed with regard to the pilot's tracking performance and workload for all three display formats. M.G.

N81-24041# Federal Aviation Administration, Atlantic City, N.J.
VISUAL CONFIRMATION OF VOICE TAKEOFF CLEARANCE (VICON) OPERATIONAL EVALUATION, VOLUME 1 Final Report, Sep. 1977 - Oct. 1980
John J. Maurer, B. Castle, E. Rowe, B. Hughes, and R. Nelson Feb. 1981 433 p refs 2 Vol.
(FAA Proj. 143-152-400)
(AD-A097756; FAA-CT-80-60-1-Vol-1;
FAA-RD-80-114-1-Vol-1) Avail: NTIS HC A19/MF A01 CSCL 17/7

An operational evaluation was conducted at Bradley International Airport, Windsor Locks, Connecticut, to test and experimental visual (light) system which would confirm the voice takeoff clearance issued by the controller. The effort was in response to the tragic incident which occurred in March of 1977 on Tenerife Island where two Boeing 747's collided because of an apparent misunderstanding of air traffic control verbal instructions. This experimental system called Visual Confirmation of Voice Takeoff Clearance (VICON) consisted of a cluster of three PAR56 lamps with green lenses which were installed at all departure points on the airport with the activation of each cluster controlled by the air traffic controller. Results indicated that the VICON system equipment and components operated in a highly reliable fashion during the entire evaluation period. Data collected and analyzed by a contractor indicated that VICON was technically feasible; however, VICON did not demonstrate that it enhanced safety. Author (GRA)

N81-24042# Federal Aviation Administration, Atlantic City, N.J.
VISUAL CONFIRMATION OF VOICE TAKEOFF CLEARANCE (VICON) OPERATIONAL EVALUATION. VOLUME 2: OPERATIONS AND MAINTENANCE MANUAL Final Report, Sep. 1977 - Mar. 1980
John J. Maurer, B. Castle, A. K. Novakoff, R. Nelson, S. Roditi, and F. P. Zito Feb. 1981 285 p 2 Vol.
(FAA Proj. 143-152-400)
(AD-A098093; FAA-CT-80-60-2-Vol-2;

FAA-RD-80-114-2-Vol-2) Avail: NTIS HC A14/MF A01 CSCL 17/7

This document is Volume II of the Visual Confirmation of Voice Takeoff Clearance (VICON) Operational Evaluation. It contains working drawings and schematic diagrams, technical details, and maintenance and detailed operational procedures for the VICON system that was installed at Bradley International Airport, Windsor Locks, Connecticut. The drawings, instructions, and charts in this volume are reproduced exactly as they were used by the Bradley maintenance and air traffic control specialists; no effort was made to formalize or improve the appearance of this information. This volume, therefore, would be utilized if one is interested in considering future implementation or design modification of the VICON system. Seven appendices were added in order to consolidate under one cover the various operational, maintenance, and design details for the VICON system and its components. GRA

N81-24043# Naval Surface Weapons Center, Dahlgren, Va. Strategic Systems Dept.

GLOBAL POSITIONING SYSTEM SENSITIVITY EXPERIMENT Final Report

Alan G. Evans, Bruce R. Hermann, and Patrick J. Fell Jan. 1981 27 p refs

(AD-A097851; NSWC/TR-81-4) Avail: NTIS HC A03/MF A01 CSCL 17/7

This experiment demonstrated the obtainable accuracy for estimating changes in a receiver antenna position using Doppler techniques and the NAVSTAR Global Positioning System (GPS). The antenna was periodically moved to three locations approximately 2 to 3 meters apart. The moves occurred within a one minute Doppler count interval every fifteenth interval until at least six Doppler measurements were made for each location change. These measurements were used to determine the observed change in range from the antenna to the GPS satellite due only to the movement of the antenna. The calculated change in range was computed from the surveyed distance moved and the angular differences in elevation and azimuth between the direction of the move and the direction of the satellite. The observed and calculated changes in range were compared. The three dimensional antenna position changes were estimated using six observed change in range measurements for each location change. The estimated results were compared with surveyed values and demonstrated subdecimeter accuracy. Author (GRA)

N81-24044# Mitre Corp., McLean, Va.

DISCRETE ADDRESS BEACON SYSTEM (DABS) DATA LINK CAPACITY UTILIZATION Interim Report

Anand D. Mundra Nov. 1980 94 p refs

(Contract DOT-FA80WA-4370)

(AD-A098173; MTR-80W301; FAA-RD-81-14) Avail: NTIS HC A05/MF A01 CSCL 17/7

The Discrete Address Beacon System (DABS) will provide the basis for the automation of many air traffic control system functions envisioned in the near future, most notable amongst these being the Automatic Traffic Advisory and Resolution Service (ATARS). This document describes a set of services that may reasonably be expected to be provided by DABS in its first ten years of deployment. It establishes approximate capacity requirement placed on the DABS sensor and upper limits on the total amount of radio signals transmitted by the sensor in order to provide these services. The analysis is based on DABS and ATARS system definitions known as of July 1979. A final report, identifying exact DABS capacity requirements for providing these services, will be published at a later date. Author (GRA)

N81-24045# Bodenseewerk Geraetetechnik G.m.b.H., Ueberlingen (West Germany).

IMPROVEMENT OF GUIDANCE AND HANDLING QUALITIES IN THE VICINITY OF AIRPORTS AND ON LANDING Final Report

Gernot Engler, Klaus Marschall, Richard Sponholz, Gerhard Weber, and Wilfried Wellern Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 165 p refs In GERMAN; ENGLISH summay

(BMFT-FB-W-79-42; ISSN-0170-1339) Avail: NTIS HC A08/MF A01

The design, development, and testing of a digital integrated flight guidance system is described. A complete uninterrupted combination of operational modes exists for the different degrees of automation considered. The structure of the autonomous digital control panel for data input and output is explained. This panel also serves as a signal interface for data transfer from the control computer. Control alogrithms and data transfer control functions are described. The agreement between the results of ground flight simulation and the results of test flights confirmed the correctness of the hypotheses used. Author (ESA)

N81-24046# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Stabsabteilung Programmvorbereitung.

DEFINITION OF A SYSTEM CONCEPT STUDY FOR FUTURE AIR TRAFFIC GUIDANCE Final Report

Friedrich Suess and Heinz L. Cohrs (Standar Elektrik Lorenz A.G., Stuttgart) Bonn Bundesministerium fuer Forschung und Technologie Sep. 1980 74 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-W-80-008; ISSN-0170-1339) Avail: NTIS HC A05/MF A01

A system capable of handling a much greater volume of traffic in the European airspace is described. Current methods are incapable of handling the projected doubling of traffic in twenty years time. Existing traffic forecasts, current regulations and information on the performance of currently existing systems were used as a basis for the development proposed. Airborne, ground based and satellite data were employed. The different functions performed by the various elements are established together with the hierarchical relations between them. Appropriate extrapolation and optimization allows the future system to be defined. Author (ESA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N81-24047*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.

AIRCRAFT CANOPY LOCK Patent Application

George H. Nichols, inventor (to NASA) Filed 30 Mar. 1981 14 p

(NASA-Case-FRC-11065-1; US-Patent-Appl-SN-248744) Avail: NTIS HC A02/MF A01 CSCL 01C

A manually-operable lock for releasably securing a canopy in closed condition is characterized by (1) a pair of dogs mounted in fore-and-aft alignment on the wall of the cockpit of an aircraft; (2) a pair of dog receivers mounted on the canopy in juxtaposition with the dogs when the canopy is in its closed condition; (3) a dog-actuating arm including internal and external arm components, respectively, supported for oscillation about a common axis and pivotally connected to the dogs through a pitman rod for pivotally displacing the dog; (4) a spring-loaded pin mounted on the arm and adapted to be ramp-cammed and positioned in coaxial alignment with a receiving bore, when the arm is at the limit of its forward throw; and (5) pin-release means including external and internal components, respectively, for releasing the arm for pivotal displacement. NASA

N81-24048*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.

APPLICATION OF A PERFORMANCE MODELING TECHNIQUE TO AN AIRPLANE WITH VARIABLE SWEEP WINGS

Paul C. Redin May 1981 33 p refs

(NASA-TP-1855; H-1131) Avail: NTIS HC A03/MF A01 CSCL 01C

A performance modeling concept previously applied to an F-104F G and a YF-12C airplane was applied to an F-111A airplane. This application extended the concept to an airplane with variable sweep wings. The performance model adequately

matched flight test data for maneuvers flown at different wing sweep angles at maximum afterburning and intermediate power settings. For maneuvers flown at less than intermediate power, including dynamic maneuvers, the performance model was not validated because the method used to correlate model and in-flight power setting was not adequate. Individual dynamic maneuvers were matched sucessfully by using adjustments unique to each maneuver. Author

N81-24049# Dayton Univ., Ohio.
STUDY AND EVALUATION OF EXISTING TECHNIQUES FOR MEASURING AIRCRAFT WINDSCREEN OPTICAL QUALITY: DEVELOPMENT OF NEW TECHNIQUES FOR MEASURING AIRCRAFT WINDSCREEN OPTICAL DISTORTION
J. S. Harris and K. G. Harding Wright-Patterson AFB, Ohio AMRL Feb. 1981 127 p
(Contract F33615-78-C-0501; AF Proj. 7184)
(AD-A097731; AFAMRL-TR-81-25) Avail: NTIS HC A07/MF A01 CSCL 01/2

A program to study and develop techniques for evaluating windscreen optical quality was conducted in suport of the Aerospace Medical Research Laboratory's windscreen program. The bird impact resistant transparency (BIRT) windscreens under study were both thick and lightweight laminated components developed to reduce the threat to low-flying aircraft from bird impact. Visual performance is affected by several optical variables of the windscreen; however, this program addressed only the techniques used to evaluate optical distortion. Results of the study indicated that grid board photographic techniques are simple and easy to perform, but errors as large as 20% occur in manual data reduction. Point-by-point measurement of F-111 windscreen optical distortion has shown that this technique provides high accuracy, but is very time consuming. Point-by-point measurements of four representative F-11 windscreens have shown that angular deviations will not usually exceed 40 minutes of arc and that localized optical distortion effects are characterized by large, highly localized variations in angular deviations. Techniques using raster scanned laser probe beams in conjunction with ratio reflecting screens and holographic lenses could provide the capability for high speed evaluation of optical distortion in windscreens. The technique to be developed for quantified evaluation of optical distortion should be a grid board photographic system. A grid board digitization system is described to eliminate data reduction errors. GRA

N81-24050# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
METHOD FOR COMPUTATION OF STRUCTURAL FAILURE PROBABILITY FOR AN AIRCRAFT Final Report
John W. Lincoln Jul. 1980 76 p refs
(AD-A098294; ASD-TR-80-5035) Avail: NTIS HC A05/MF A01 CSCL 20/11

This report describes a procedure for computing the probability of aircraft failure of a given aircraft type as a function of flight time. Specifically, the single flight probability of failure, the aircraft probability of failure after a given number of flight hours and the expected number of aircraft losses are calculated. The approach is through fracture mechanics where the distribution of flaws in the structure is represented and combined with the probability of stress exceedance. The computation will allow for structural inspections and rework. The listing of the computer routine and a sample problem to illustrate the method is included. GRA

N81-24051# Aeronautical Research Labs., Melbourne (Australia).
A REVIEW OF AUSTRALIAN INVESTIGATIONS ON AERONAUTICAL FATIGUE Structures Technical Memo, Apr. 1979 - Mar. 1981
G. S. Jost Mar. 1981 66 p
(AD-A098300; ARL/STRUC-TM-327) Avail: NTIS HC A04/MF A01 CSCL 20/1

A summary is presented of the aircraft fatigue research and associated activities which form part of the programs of the Aeronautical Research Laboratories, Commonwealth Aircraft Corporation Pty. Ltd., Department of Transport (Airworthiness Branch), Royal Australian Air Force and the Government Aircraft Factories. The major topics discussed include the fatigue of both civil and military aircraft structures, fatigue damage repair and refurbishment and fatigue life monitoring and assessment. GRA

N81-24052# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
CIVIL COMPONENT PROGRAM WING SECTION. TRANSONIC WING DEVELOPMENT Final Report
Reinhard Hilbig Bonn Bundesministerium fuer Forschung und Technologie Sep. 1980 81 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-80-021; ISSN-0170-1339) Avail: NTIS HC A05/MF A01

The transonic wing ZKP-F1, designed for the A-310 aircraft development program, is discussed. The design criteria are explained, and a design analysis is undertaken. The airfoil flow characteristics are established over major regions of the wing span. Transonic wind tunnel test results are cited which confirm design expectations, while verifying practical wing flow insensibility to interference. An advanced wing (B10.3V) which shows improved flow characteristics both in wing root and in the leading edge region along the whole wing span without affecting off-design qualities, is presented. Its planned application in the large scale A-310 model is noted. Author (ESA)

N81-24053# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany).
CIVIL COMPONENT PROGRAM WING SECTION. THE DESIGN OF THE TRANSONIC AIRFOIL VA 2 Final Report
Reinhard Hilbig Bonn Bundesministerium fuer Forschung und Technologie Sep. 1980 56 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-80-023; ISSN-0170-1339) Avail: NTIS HC A04/MF A01

The design lift and Mach number criteria are reviewed, and the optimization of off-design characteristics is discussed for the Va transonic wing. A design analysis is presented, citing transonic wind tunnel test results. A shock free pressure distribution is achieved for a wide range of Mach numbers and angles of attack below the design case. The off-design shock caused by overstepping design Mach number or angle of attack, respectively, can be stabilized at a limited downstream position. Author (ESA)

N81-24054# Societe Nationale Industrielle Aerospatiale, Paris (France).
QUALITY IN DESIGN [LA QUALITE DANS LA CONCEPTION]
G. Correge 1980 42 p In FRENCH Presented at FRAMATOME Conf., Paris, 26 Feb. 1980
(SNIAS-802-111-108) Avail: NTIS HC A03/MF A01

Those aspects of management which contribute to assuring the adequacy of a product (aircraft) to meet the needs of a customer for reliability, and to satisfy aeronautical certification, are analyzed. The optimal management of quality from the inception of an aircraft design to final checkout and acceptance of the manufactured system is sought. All available options are examined, following the flow of product development through the various phases of realization. Exhaustive lists of the means, methods, and mechanisms for getting the job done are presented, the favorable combination of which leads to a product well-adapted for user and official requirements. Author (ESA)

N81-24055# Societe Nationale Industrielle Aerospatiale, Paris (France).
THE AIRBUS HYDRAULIC SYSTEMS [LES SYSTEMES HYDRAULIQUES DE L'AIRBUS]
Claude Galy 1980 9 p In FRENCH Presented at Club le Pascal Conf. on Les Systemes, Paris, 12 Sep. 1980 Submitted for publication
(SNIAS-802-111-111) Avail: NTIS HC A02/MF A01

The evolution of hydraulic servocommand systems in civil aeronautics applications is briefly reviewed, leading to a functional overview of the Airbus hydraulic equipment. Taking the A300B hydraulics as an example, the design philisophy is reviewed, and the monitoring of hydraulic equipment is explained. Various control surfaces operated hydraulically are then discussed. The principal subsystems, i.e., landing gear, front wheel steering, and brakes, are also described. Safety features are analyzed, and possibilities for extending hydraulics applications, e.g., stability control, wing profile control, are reported. Author (ESA)

N81-24056# Societe Nationale Industrielle Aerospatiale, Paris (France).
GENERALITIES ON ACTIVE CONTROL. POTENTIALS AND RESEARCH TRENDS [CONTROLE ACTIF GENERALISE. POTENTIALITES ET AXES D'EFFORT]
Y. Negre 1980 22 p In FRENCH; ENGLISH summary Presented at 17th AAAF Colloq. d'Aeronyn. Appl., Grenoble, France, 12-14 Nov. 1980
(SNIAS-802-111-112) Avail: NTIS HC A02/MF A01

The applications of active control in aeronautics are arbitrarily classified, and short term potential for development is assessed. Progress is essentially reported for transport aircraft design, especially in instability control, load control and in wing camber control. Specific development programs, mainly concerning the European AIRBUS, are illustrated. Results pertain to longitudinal stability control, wing loading control, and wing camber control at high speed. Author (ESA)

N81-24057# Societe Nationale Industrielle Aerospatiale, Toulouse (France). Div. Avions.
THE FUTURE COCKPIT OF THE NEXT GENERATION OF CIVIL AIRCRAFT
J. P. Laboire Paris 1980 8 p Presented at ICAS Conf., Munich, 13-17 Oct. 1980
(SNIAS-802-111-113; ICAS-80-8.2) Avail: NTIS HC A02/MF A01

The cockpit of the Airbus A 310 which uses cathode ray tube (CRT) displays and illuminated push buttons is described. The flight deck includes six completely interchangeable CRT's for flight and navigation information and aircraft systems monitoring. Conventional instruments are used as backup. Shadow mask technology is used for the CRT's, with in-line gun alignment. Symbols are composed of strokes and seven colors are available. The primary flight display shows attitude, heading, slip, flight path vector altitude, and airspeed. The navigation display can display a map of the flight plan at various scales. Weather radar navigation data may be suferimposed. The systems monitoring CRT's display schematics of major systems, and show warnings as appropriate. Author (ESA)

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N81-24058*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FLIGHT EVALUATION OF A SIMPLE TOTAL ENERGY-RATE SYSTEM WITH POTENTIAL WIND-SHEAR APPLICATION
Aaron J. Ostroff, Richard M. Hueschen, R. F. Hellbaum, and J. F. Creedon May 1981 52 p refs
(NASA-TP-1854; L-14209) Avail: NTIS HC A04/MF A01 CSCL 01D

Wind shears can create havoc during aircraft terminal area operations and have been cited as the primary cause of several major aircraft accidents. A simple sensor, potentially having application to the wind-shear problem, was developed to rapidly measure aircraft total energy relative to the air mass. Combining this sensor with either a variometer or a rate-of-climb indicator provides a total energy-rate system which was successfully applied in soaring flight. The measured rate of change of aircraft energy can potentially be used on display/control systems of powered aircraft to reduce glide-slope deviations caused by wind shear. The experimental flight configuration and evaluations of the energy-rate system are described. Two mathematical models are developed: the first describes operation of the energy probe in a linear design region and the second model is for the nonlinear region. The calculated total rate is compared with measured signals for many different flight tests. Time history plots show the tow curves to be almost the same for the linear operating region and very close for the nonlinear region. J.M.S.

N81-24059# Lear Siegler, Inc., Grand Rapids, Mich. Instrument Div.
REQUIREMENTS, TECHNOLOGY AND CONFIGURATION EVALUATION FOR CRASH SURVIVABLE FLIGHT DATA RECORDING (CSFDR) SYSTEM Final Report, 23 Jul. 1980 - 23 Mar. 1981
Howard Branch, Barry Casey, Robert Harvey, William Plouff, John Reeves, and Steve Wichmann Wright-Patterson AFB, Ohio ASD 23 Mar. 1981 415 p
(Contract F33615-80-C-0117)
(AD-A097863; ASD-TR-81-5009) Avail: NTIS HC A18/MF A01 CSCL 14/3

This report addresses the tasks required to determine whether or not a Crash-Survivable Flight Data Recording (CSFDR) System which meets the critical performance requirements and cost constraints dictated by the attack/fighter/trainer (A/F/T) application, can be defined with current avionics technology for a volume production program. The first task addressed is that of determining the technical requirements. Following this, the tasks required to formulate the well-defined technical approach are addressed. These tasks include studies relative to standardization, expanded recording, data security, required readout equipment, and future aircraft applications. Special emphasis is given to potential memory technologies, data processing/compression techniques, and required software/firmware for the CSFDR system. Following these technical areas of study, the economic areas of life cycle costs (LCC) and cost/benefit are analyzed. The recommendation is to continue work in the CSFDR area. GRA

N81-24060# Technology, Inc., Dayton, Ohio.
STRUCTURAL INTEGRITY RECORDING SYSTEM (SIRS) FOR U.S. ARMY AH-1S HELICOPTERS Final Report, Oct. 1977 - Oct. 1980
James G. Dotson and Axel W. Kolb Mar. 1981 250 p
(Contract DAAJ02-77-C-0079)
(AD-A098236; USAAVRADCOM-TR-81-D-6) Avail: NTIS HC A11/MF A01 CSCL 14/3

A research and development program for an improved Army AH-1S helicopter Structural Integrity Recording System (SIRS) was conducted to track fatigue damage accumulation on critical helicopter components. The work was divided into five tasks. Task I included modification of hardware and software of five SIRS recorders fabricated under a previous contract, recording of histogram data on flight conditions representative of current missions flown by AH-1S helicopters, determination of the tail rotor usage spectrum, and recording of flight parameters such as rotor RPM, engine torque, airspeed, altitude, acceleration, outside air temperature, gross weight, and pitch and roll attitude. Task II comprised all work required for installation of the SIRS recorders in AH-1S helicopters. Under Tasks III, IV, and V, installation of the flight recorders, monthly retrieval of data from the five aircraft, processing of data, and removal of the recorders and installation kits was performed. Recommendations for additional improvements on the recorder system and its utilization conclude this report. Author (GRA)

N81-24061# Societe Nationale Industrielle Aerospatiale, Paris (France).
DEVELOPMENT OF INSTRUMENTATION FOR PILOTS. CRT SCREENS [EVOLUTION DES OUTILS MIS A LA DISPOSITION DES PILOTES. ECRANS CATHODIQUES]
J. P. Laborie 20 Mar. 1980 13 p In FRENCH Presented at AFCET Journee l'Homme et les Automatismes, Paris, 20 Mar. 1980
(SNIAS-802-111-114) Avail: NTIS HC A02/MF A01

The development of CRT displays in the cockpit as part of the trend towards numerical flight control is reviewed. The architecture of automatic control systems is discussed, emphasizing the eventual introduction of generalized active control. The impact of digital techniques on cockpit design is illustrated. Flight instrument layouts for the advanced A-300 and for the A-310 aircraft are cited as examples. It is included that improvements in CRT technology favor their implementation in aircraft numerical control systems. Author (ESA)

N81-24062# Societe Nationale Industrielle Aerospatiale, Paris (France). Dept. des Systemes Avances.
SYSTEM DIGITIZATION: ITS EFFECT IN THE COCKPIT
J. P. Laboire 1980 35 p In ENGLISH and FRENCH Presented

at 17th Gen. Assembly of European Organ. for Civil Aviation Electron., Amsterdam, 25 Apr. 1980
(SNIAS-802-111-115) Avail: NTIS HC A03/MF A01

The evolution of digital techniques in aircraft flight control, avionics and cockpit displays is traced, and anticipated installations on the advanced Airbus are mentioned. Weight savings and reliability improvements (mean time between failure) are given for categories of digital equipment. Secondary flight controls (high lift devices, air brakes and bank controls) will be digitally controlled, achieving performance improvement and weight savings. In the A 310 and advanced A 300, two cockpit options will be offered, a lateral engineer's position, or a forward facing crew cockpit. The instrument panel will include six cathode ray tube displays for flight instrumentation, navigation, warnings and system surveillance. Author (ESA)

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N81-24063*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FUNDAMENTAL HEAT TRANSFER RESEARCH FOR GAS TURBINE ENGINES
Darryl E. Metzger, ed. (Arizona State Univ.) 1980 68 p refs Presented at a Workshop Held at Cleveland, 8-9 Oct. 1980
(NASA-CP-2178; E-666) Avail: NTIS HC A04/MF A01 CSCL 21E

Thirty-seven experts from industry and the universities joined 24 NASA Lewis staff members in an exchange of ideas on trends in aeropropulsion research and technology, basic analyses, computational analyses, basic experiments, near-engine environment experiments, fundamental fluid mechanics and heat transfer, and hot technology as related to gas turbine engines. The workshop proceedings described include pre-workshop input from participants, presentations of current activity by the Lewis staff, reports of the four working groups, and a workshop summary. A.R.H.

N81-24064*# Flight Dynamics Research Corp., Van Nuys, Calif.
A JET-DIFFUSER FOR EJECTOR A V/STOL FIGHTER Contractor Final Report, Sep. 1979 - Apr. 1981
Morton Alperin and Jiunn-Jeng Wu Feb. 1981 50 p refs Sponsored in part by Naval Air Development Center
(Contract NAS2-10373)
(NASA-CR-166161) Avail: NTIS HC A03/MF A01 CSCL 21E

A single ejector equipped with only one vector control jet and a diffuser flap was installed close to the leading edge of the strake of a one-fifth scale, semi-span model of the aircraft, without wing, canard, or tail surface. Tests of the system at a nozzle pressure ratio of 1.24 indicated a thrust augmentation of 1.92 and a thrust in the flight direction of about 12% of the total thrust under static conditions. An ejector stall occured at a ratio of tunnel dynamic pressure to nozzle gage pressure of about 0.008. Ejector stall speed can be delayed by using a boundary layer control jet at the front inlet lip of the ejector. T.M.

N81-24065*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF EFFECT OF FLAMEHOLDER CHARACTERISTICS ON LEAN, PREMIXED, PARTIALLY VAPORIZED FUEL-AIR MIXTURES QUALITY AND NITROGEN OXIDES EMISSIONS
Larry P. Cooper May 1981 18 p refs
(NASA-TP-1842; E-563) Avail: NTIS HC A02/MF A01 CSCL 21E

An analysis was conducted of the effect of flameholding devices on the precombustion fuel-air characteristics and on oxides of nitrogen (NOx) emissions for combustion of premixed partially vaporized mixtures. The analysis includes the interrelationships of flameholder droplet collection efficiency, reatomization efficiency and blockage, and the initial droplet size distribution and accounts for the contribution of droplet combustion in partially vaporized mixtures to NOx emissions. Application of the analytical procedures is illustrated and parametric predictions of NOx emissions are presented. Author

N81-24066*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TOP-MOUNTED INLET SYSTEM FEASIBILITY FOR TRANSONIC-SUPERSONIC FIGHTER AIRCRAFT
T. L. Williams (Northrop Corp., Hawthone, Calif.), B. L. Hunt (Northrop Corp., Hawthorne, Calif.), D. B. Smeltzer, and W. P. Nelms Apr. 1981 20 p refs
(NASA-TM-81292; A-8575) Avail: NTIS HC A02/MF A01 CSCL 21E

The more salient findings are presented of recent top inlet performance evaluations aimed at assessing the feasibility of top-mounted inlet systems for transonic-supersonic fighter aircraft applications. Top inlet flow field and engine-inlet performance test data show the influence of key aircraft configuration variables-inlet longitudinal position, wing leading-edge extension planform area, canopy-dorsal integration, and variable incidence canards-on top inlet performance over the Mach range of 0.6 to 2.0. Top inlet performance data are compared with those or more conventional inlet/airframe integrations in an effort to assess the viability of top-mounted inlet systems relative to conventional inlet installations. A.R.H.

N81-24067*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
STRUCTURES, PERFORMANCE, BENEFIT, COST STUDY Final Report
E. Feder Apr. 1981 77 p
(Contract NAS3-22050)
(NASA-CR-165313; PWA-5706-16) Avail: NTIS HC A05/MF A01 CSCL 21E

Aircraft engine structures were studied to identify the advanced structural technologies that would provide the most benefits to future aircraft operations. A series of studies identified engine systems with the greatest potential for improvements. Based on these studies, six advanced generic structural concepts were selected and conceptually designed. The benefits of each concept were quantitatively assessed in terms of thrust specific fuel consumption, weight, cost, maintenance cost, fuel burned and direct operating cost plus interest. The probability of success of each concept was also determined. The concepts were ranked and the three most promising were selected for further study which consisted of identifying and comprehensively outlining the advanced technologies required to develop these concepts for aircraft engine application. Analytic, fabrication, and test technology developments are required. The technology programs outlined emphasize the need to provide basic, fundamental understanding of technology to obtain the benefit goals. A.R.H.

N81-24068*# Solar Turbines International, San Diego, Calif.
INTERNAL COATING OF AIR-COOLED GAS TURBINE BLADES Final Report, May 1979 - Nov. 1980
L. L. Hsu and A. R. Stetson Dec. 1980 170 p refs
(Contract NAS3-28142)
(NASA-CR-165337; SRBI-R-4828-16) Avail: NTIS HC A08/MF A01 CSCL 21E

Four modified aluminide coatings were developed for IN-792 + Hf alloy using a powder pack method applicable to internal surfaces of air-cooled blades. The coating compositions are Ni-19Al-1Cb, Ni-19Al-3Cb, Ni-17Al-20Cr, and Ni-12Al-20Cr. Cyclic burner rig hot corrosion (900 C) and oxidation (1050 C) tests indicated that Ni-Al-Cb coatings provided better overall resistance than Ni-Al-Cr coatings. Tensile properties of Ni-19Al-1Cb and Ni-12Al-20Cr coated test bars were fully retained at room temperature and 649 C. Stress rupture results exhibited wide scatter around uncoated IN-792 baseline, especially at high stress levels. High cycle fatigue lives of Ni-19Al-1Cb and Ni-12Al-20Cr coated bars (as well as RT-22B coated IN-792)

suffered approximately 30 percent decrease at 649 C. Since all test bars were fully heat treated after coating, the effects of coating/processing on IN-792 alloy were not recoverable. Internally coated Ni-19Al-1Cb, Ni-19Al-3Cb, and Ni-12Al-20Cr blades were included in 500-hour endurance engine test and the results were similar to those obtained in burner rig oxidation testing. Author

N81-24069# Williams Research Corp., Walled Lake, Mich.
WR34-8 PERFORMANCE IMPROVEMENT PROGRAM. THE WR34-8 GAS TURBINE COMPRESSOR TEST Final Report
D. Best and R. Honn 3 Apr. 1981 90 p
(Contract DAAK70-80-C-0129)
(AD-A098293; WRC0129-TR-81-1; FSC-24235) Avail: NTIS HC A05/MF A01 CSCL 21/5

A rig test was conducted to identify the performance map for the Williams Research Corporation WR34 engine single-stage centrifugal compressor. At the compressor design point, which is at a corrected airflow of 0.538 lbm/sec and speed of 99,050 rpm, an efficiency of 74 percent at a pressure ratio of 4.25:1 was attained. Use of the tested compressor performance in the WR34 engine computer simulation showed that the contractual goal of 27.7 horsepower on a 107 F day at an altitude of 5000 feet can be met. GRA

N81-24070# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
TURBINE WINDAGE TORQUE TESTS Final Report, 20 Aug. 1979 - Oct. 1980
R. F. Sutton Jan. 1981 154 p refs
(Contract F33615-79-C-2073; AF Proj. 3145)
(AD-A098310; RI/RD80-220; AFWAL-TR-80-2123) Avail: NTIS HC A08/MF A01 CSCL 21/5

Systems for producing high electrical power on demand include the use of a turbine/gas generator system. The power absorption by turbine windage is an important factor in determining the sizes of the vacuum pump and drive, if the turbine exhaust cavity is to be evacuated, and the size and quality of the vacuum isolation valve on the turbine exhaust system. Rocketdyne conducted windage torque tests on a MK15E3-2 turbine at speeds up to 30,000 RPM where torque contributions of shrouded and unshrouded wheels, single wheel, and bearing and seal power losses were determined at turbine cavity air pressure of 0.3 psia to atmospheric pressure (14.3 psia). Windage torque losses of the shrouded two-wheel system at atmospheric conditions represented about 2.6 percent of the overall rated turbine horsepower (155 versus 6,000 HP). Author (GRA)

N81-24071# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
TURBINE ENGINE TESTING
Jan. 1981 471 p refs In ENGLISH and FRENCH Proceedings of the 56th Symp. of the AGARD Propulsion and Energetic Panel, Turin, 29 Sep. - 3 Oct. 1980
(AGARD-CP-293; ISBN-92-835-0282-5) Avail: NTIS HC A21/MF A01

Increasing demands on turbine engines performance, durability, safety, and pollution emission require an improvement in test methods. Test methods are provided for the engine research and development engineers in order to help them meet the manufacturers', the buyers', and the users' test requirements for engine delivery, reliability, economy, and maintenance. A comprehensive survey on testing requirements for engine qualification and development are provided for both military and civil engines. Engine component testing and complete power plant testing are discussed. Trends for future testing are considered. For individual titles, see N81-24072 through N81-24105.

N81-24072# Registro Aeronautico Italiano, Rome. Div. Generale.
OVERVIEW OF ALL CIVIL AVIATION ENGINE CERTIFICATION/DEMONSTRATION REQUIREMENTS AND RATIONALE, I.E., FAA, CAA, ETCETERA
V. Fiorini *In* AGARD Turbine Engine Testing Jan. 1981 17 p refs (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

Two outstanding codes for civil certification of aircraft turbine engines, one adopted in the U.S., FAR 33, and the other widely adopted in Europe, JAR 'E', are discussed and compared. The different existing philosphies, procedures, and different manufacturers positions on both sides of the Atlantic are examined. Significant items are identified and are discussed extensively with the purpose of detailing a comparison between the two sets of rules as follows: power ratings; endurance testing; stress and fatigue aspects of rotating parts; foreign object ingestion; ice protection; and engine fault analysis. T.M.

N81-24073# Naval Air Propulsion Test Center, Trenton, N.J.
SPECIFICATION REQUIREMENTS FOR FIGHTER ENGINES
Martin E. Dell *In* AGARD Turbine Engine Testing Jan. 1981 16 p refs (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

Military Specification MIL-E-5007D, a general specification for the development of turbofan/turbojet engines, has been used by the U.S. Government for the procurement of new engines since 1973. This specification was tailored and applied by the U.S. Navy to the F404-GE-400 engine (F-18 aircraft) development program. The military general specification philosophy for the procurement of turbojet/turbofan engines using MIL-E-5007D is discussed. With heavy emphasis on technical requirements and assurance tests related to engine durability, improvements in MIL-E-5007D over previous specifications, experiences in applying MIL-E-5007D to the F404 engine development program, and assurance test approaches being considered for a revision to MIL-E-5007D are described. T.M.

N81-24074# Bundesamt fuer Wehrtechnik und Beschaffung, Munich (West Germany).
CERTIFICATION PROCEDURE FOR MILITARY ENGINES IN GERMANY
Fritz Biel *In* AGARD Turbine Engine Testing Jan. 1981 6 p refs (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

The procedure is shown to be in agreement with the air transportation legislation of Germany. The activities in the course of development and during usage are presented with special emphasis on the aspect that the BWB-ML is only occupied with the subject of airworthiness, free from the need for the pursuance of schedule and financial matters. Differences in the procedures and the organization of other countries are shown. T.M.

N81-24075# Ministry of Defence, London (England). Directorate of Engine Technology.
SPECIFICATION AND REQUIREMENTS RATIONALE FOR MILITARY AND CIVIL HELICOPTER ENGINES
M. D. Paramour *In* AGARD Turbine Engine Testing Jan. 1981 14 p (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

The endurance and supplementary qualification testing required for the granting of Type Approval of military helicopter engines was reviewed. The rationale of these is given, and variations in different nation's requirements are discussed. A comparison is made with civil certification requirements. Attention is drawn to differences between the requirements for helicopter and fixed-wing aircraft engines. It is illustrated how service experience has revealed certain deficiencies in the test requirements, and has led to the development of more realistic procedures. The options considered for the current review of the UK qualification requirements are discussed. T.M.

N81-24076# Boeing Commercial Airplane Co., Seattle, Wash. Propulsion Technology Div.
BOEING COMMERCIAL AIRPLANE COMPANY ENGINE PROCUREMENT PRACTICES
D. C. Nordstrom, D. W. Bouwer, and R. A. Mays *In* AGARD Turbine Engine Testing Jan. 1981 5 p (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

For the past decade Boeing had a unique position among the world's commercial airframe companies in offering major portions of product line with a variety of engines supplied by all three large commercial manufacturers. An example is the 747 airplane with 15 engines at 12 thrust in 6 nacelles. New

airplanes, the 757 and 767, are also being offered with several engines from the same manufacturers. Boeing developed a framework of interrelated documents and internal evaluation methodology to ensure consistency and control of these multiple engine offerings. The documentary framework currently used is defined and engine performance evaluation and development program monitoring methods are provided. T.M.

N81-24077# Lockheed-California Co., Burbank.
PROPULSION SYSTEM TESTING REQUIREMENTS FOR A COMMERCIAL TRANSPORT
J. F. Stroud *In* AGARD Turbine Engine Testing Jan. 1981 13 p ref (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

Development and demonstration testing requirements for the next family of transport engines are described. Propulsion system performance and function testing are included with emphasis on performance. Rationale is provided for the major test required. The testing requirements identified reflect experience gained in the L-1011 program. The need for integrated, closely coordinated programs involving the airframe and engine companies is stressed. The test concepts, objectives, and definition of what constitutes performance demonstration are agreed before the airplane program go-ahead. Responsibilities for the various tests are assigned to the engine and airframe companies as appropriate. The requirement for correlating ground and flight propulsion performance results is discussed. T.M.

N81-24078# Societe Nationale Industrielle Aerospatiale, Toulouse (France). Div. Avions.
PERFORMANCE CONTROL AND QUALIFICATION TESTS OF CIVIL AVIATION TURBINE ENGINES IN TESTS CONDUCTED BY AIRFRAME MANUFACTURERS [CONTROLE DES PERFORMANCES ET ESSAIS DE QUALIFICATION DES MOTEURS CIVILS DANS LE CADRE DES ESSAIS AVIONNEURS]
G. Theron *In* AGARD Turbine Engine Testing Jan. 1981 7 p In FRENCH (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

The economic return of double flow turbine engines rests for a large part on the performance at takeoff; therefore, it is very important to know the evolution of power in the turbine during this phase of flight which is characterized by a particular use of the engine. The airframe manufacturer must study the relations associated with power as a parameter of the principal behavior of the engine, after start-up as well as at increased regimes. The evolution of this same parameter of behavior (constant position of the lever) related to dynamic and thermal characteristics to which the engine is subjected must also be studied. After adjustment of the lever, the regulation system actually put into operation imperfectly controls this parameter of behavior, provoking a dispersion of these evolutions. For the next generation of engines, better performing regulators are proposed which should permit the improvement of performance and of the life of the engines. Transl. by A.R.H.

N81-24079# Rolls-Royce Ltd., Derby (England).
DEVELOPMENT OF TEST REQUIREMENTS FOR CIVIL ENGINES
J. M. Cundy *In* AGARD Turbine Engine Testing Jan. 1981 16 p (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

A typical modern testing program is described covering timescale, test hours, number of engines, and the different types of testing, such as performance, environmental, system, and mechanical testing. The effects on the program of parts with long lead times, and the requirements for separate component testing are addressed. The testing conducted for manufacturer's purpose and that required by the certification authorities are compared, both for complete engines and for separate components and rigs. Typical test programs in altitude test facilities and in flight are covered. Comparisons are drawn between modern programs and associated techniques, and those in the recent past. T.M.

N81-24080# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.
DEVELOPMENT TEST REQUIREMENTS
J. B. Fyte and J. F. Montgomery (AFAPL, Wright-Patterson AFB, Ohio) *In* AGARD Turbine Engine Testing Jan. 1981 6 p refs (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

Propulsion system test requirements are established that are to provide an operationally acceptable propulsion system, and maintenance and logistic support plans which are appropriate to the usage requirements. Specific emphasis is given to the impact of changes in weapon system characteristics and usage on engine performance, operability, and life. The concept of baseline engine characteristics, including maintenance requirements based on evolving weapon system characteristics are also considered. R.C.T.

N81-24081# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.
ENGINE LIFE DEVELOPMENT
Brian Brimelow *In* AGARD Turbine Engine Testing Jan. 1981 9 p ref (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

The various parameters effecting the rapid increase of operating and support costs of aircraft engine development are graphically illustrated. The range of conditions required for the aircraft to meet its mission requirements is defined. It is shown that failure to fully establish these requirements results in an inadequate test program followed by frequent engine/control removals because of adverse tolerances stack-ups of otherwise servicable components. It is further shown that given adequate definition of aircraft requirements, shop visits for operability problems can and should be targeted so that refurbishments can be carried out at the time when the engine is removed for replacement of a limited item. R.C.T.

N81-24082# Societe Nationale d'Etudes et de Construction de Moteurs d'Aviation, Moissy-Cramayel (France).
THE SPECIFICATION OF DEVELOPMENT TESTS FOR THE ENGINE OF A COMBAT AIRCRAFT [SPECIFICATION DES ESSAIS DE DEVELOPMENT POUR UN MOTEUR D'AVION DE COMBAT]
J. Caruel *In* AGARD Turbine Engine Testing Jan. 1981 9 p In FRENCH (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

The mating of SNECMA engines with Dassault Mirage airframes has given rise to a family of aircraft whose reputation is world wide. The ATAR 9C engine equips the Mirage 3, the ATAR 9K propels the Mirage 4 of the French Strategic Air Force, and the ATAR 9K50 engine is on the Mirage F1 and just recently on the Mirage 50. Naturally the development of ATAR engines from 9C to 9K50 has been essentially in augmentation of power and PC, since they passed respectively from 4.4T to 5T and from 6.2T to 7.2T. The most recent version of Mirage aircraft, the 2000, as well as the prototype Mirage 4000 are equipped with a double flux M53 simple body engine. The method by which these two engines were developed are described. A.R.H.

N81-24083# AiResearch Mfg. Co., Phoenix, Ariz. Application Development Div.
DEVELOPMENT OF TEST REQUIREMENTS FOR CIVIL AND MILITARY AUXILIARY POWER UNITS
A. L. Romanin and S. J. Baczynski *In* AGARD Turbine Engine Testing Jan. 1981 26 p (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

The history of the gas turbine auxiliary power unit (APU) is reviewed to indicate the wide variety of design and usage requirements that have evolved. Particular emphasis is given to the requirements of unattended automatic operation responsive to multiple, variable power demands. Development and proof testing programs for civil and military requirements are formulated as a function of specific user needs and the similarity of the APU and its components to proven designs. R.C.T.

N81-24084# Air France, Paris. Service des Etudes de Propulsion.
TURBINE ENGINE TESTS AS SEEN BY AN AIRCRAFT COMPANY [LES ESSAIS REATEURS VUS PAR UNE COMPAGNIE AERIENNE]

P. Chetail *In* AGARD Turbine Engine Testing Jan. 1981 13 p refs In FRENCH (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

The need for conducting specific tests on turbine engines using ground test stands was felt not only after inspection, but also at the time of their installation in the aircraft and before their being placed in the shop for repair. Monitoring the performance degradation of engines in the course of service appears to be complementary and very desirable and should become possible by virtue of the semicontinuous recording of parameters on the aircraft, as well as by advanced performance analysis such as the GRA which, on the most recent type of civil turbines, permits more reliable evaluation of engine performance at the level of principal modules than is provided by classic methods. A.R.H.

N81-24085# Ministry of Defence, London (England). Directorate of Engine Development.
ENGINE IN-FLIGHT DATA COLLECTION AND ANALYSIS IN UNITED KINGDOM AIRCRAFT
M. F. Hurry and R. B. G. Hedgecock *In* AGARD Turbine Engine Testing Jan. 1981 13 p refs (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

The scenario of aircraft engine data collection and analysis techniques in military aircraft is presented. A status review of the work in this area is provided and some of the more important factors which influenced the work on this subject are highlighted. R.C.T.

N81-24086*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INVESTIGATION OF PERFORMANCE DETERIORATION OF THE CF6/JT9D HIGH BYPASS RATIO TURBOFAN ENGINES
Joseph A. Ziemianski *In* AGARD Turbine Engine Testing Jan. 1981 14 p refs (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01 CSCL 21E

The extent and magnitude of performance deterioration of the Pratt and Whitney JT9D, and the General Electric CF6 engine models is presented. Overall engine and contributing module performance deterioration with respect to flight cycles and/or time are analyzed. The overall engine performance deterioration analyses are based on data obtained from historical records, special engine tests, and tests for specific effects. Hardware inspection data from overhaul shops and special module tests are the basis for the modular performance deterioration data used in the analyses. Various damage mechanisms such as seal rubs, erosion, surface roughness and thermal distortion, and how they contribute to performance deterioration are included in the modular analyses. Results indicate that early performance deterioration occurring within the first few flights of these engines is less than 1 percent in cruise specific fuel consumption (SFC), that it is event oriented, and that it is the result of increased blade tip clearances. This performance deterioration gradually increases to about 2.5 to 3.0 percent (including the initial short term deterioration) after 2500 to 3000 flights where increased blade tip clearances, airfoil quality degradation, and thermal distortion are the contributing causes. R.C.T.

N81-24087# Societe Nationale d'Etudes et de Construction de Moteurs d'Aviation, Moissy-Cramayel (France).
DESIGN DEVELOPMENT, AND CERTIFICATION OF A CFN56 ENGINE: RESISTANCE TO THE INGESTION OF FOREIGN BODIES [CONCEPTION, DEVELOPPEMENT ET CERFIFICATION DU MOTEUR DFM56, RESISTANCE A L'INGESTION DES CORPS ETRANGERS]
In AGARD Turbine Engine Testing Jan. 1981 7 p In FRENCH (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

The theoretical approach used to proportion the head vanes of a civil turbomachine was correlated with experimental results. The two fold objective was to satisfy requirements for international certification (FAA, JAR-E) and to establish comfortable margins of mechanical resistance in order to minimize the costs of corrective action, thus alleviating the maintenance expenses of user companies. The motor, the theoretical approach, and the results of certification are described. The tests constructed and continually used to affirm the theoretical results, and which led to the final definition of the CFM56 engine are described.A.R.H.

N81-24088# Pratt and Whitney Aircraft, West Palm Beach, Fla. Government Products Div.
DERIVATION AND CORRELATION OF ACCELERATED MISSION ENDURANCE TESTING
Jack Sammons *In* AGARD Turbine Engine Testing Jan. 1981 4 p refs (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

An approach to defining the Accelerated Mission Test (AMT) program as an integral part of the overall engine development process is discussed. This includes not only the initial cycle derivation but also the necessary revisions to the AMT cycles in order to more accurately predict and detect certain failure modes. The validity of the test results are also established. A comparison of AMT engine hardware, and operational engine hardware having equivalent cyclic history, is used for this purpose. As an illustration of the benefits of AMT engine testing, data on several gas turbine engines are presented. Also included in the discussion are the various types of failure modes that are currently not detectable in the AMT type program. R.C.T.

N81-24089# National Gas Turbine Establishment, Farnborough (England). Engine Test Dept.
FREE-JET TESTING OF POWERPLANTS FOR AIRCRAFT AND MISSILES
P. F. Ashwood and P. DeB. Phil *In* AGARD Turbine Engine Testing Jan. 1981 24 p refs (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

The free-jet test facilities available at the National Gas Turbine Establishment for testing complete aircraft propulsion systems (the air intake, engine, and exhaust system) at conditions reproducing those encountered during flight are described. Supersonic and subsonic flight conditions can be simulated, both steady state and transient; the latter aspect including the effects of time-variant changes in aircraft flight speed, attitude, and engine power. The scope of free-jet testing is reviewed and compared with what can be achieved using direct-connect facilities. Subsonic free-jet tests made under the extreme conditions encountered in an icing cloud are discussed. The tests are designed to determine the effectiveness of intake and engine anti-icing equipment and the ability of the powerplant to operate satisfactorily following the shedding of ice that may have accreted on the inlet duct surfaces. M.G.

N81-24090# ARO, Inc., Arnold Air Force Station, Tenn.
INLET-ENGINE COMPATABILITY TESTING TECHNIQUES IN GROUND TEST FACILITIES
Jack T. Tate *In* AGARD Turbine Engine Testing Jan. 1981 17 p AEDC refs (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

A review of the available techniques for the evaluation of turbine engine stability is presented. Recommended test matrix selection criteria, instrumentation and test equipment requirements, test procedures, and analysis techniques are discussed with respect to turbine testing with three basic engine inlet environmental conditions: uniform, steady flow; steady-state distorted flow; and time-variant distorted flow. M.G.

N81-24091# National Research Council of Canada, Ottawa (Ontario). Engine Lab.
GAS TURBINE ENGINE TRANSIENT TESTING
D. M. Rudnitski *In* AGARD Turbine Engine Testing Jan. 1981 15 p (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

Methods for conducting extensive steady-state and transient-performance tests on J85-CAN-15 turbojet engines are discussed. In particular the instrumentation and techniques developed to monitor and record experimental data rapidly and accurately during rapid-transient engine operation are described. The technique provides report-quality time-plots and compressor operating lines immediately after test, thus permitting rapid assessments of engine performance. M.G.

N81-24092# General Electric Co., Lynn, Mass. Aeromechanics Group.
EXPERIMENTAL VERIFICATION OF TURBOBLADING AEROMECHANICS
V. M. Cardinale, H. R. Bankhead, and R. A. McKay *In* AGARD Turbine Engine Testing Jan. 1981 38 p refs (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

Experimental aeromechanical procedures are discussed and the process of valid design assessment, avoiding highly theoretical approaches and concepts is addressed. The procedures include methods used in design verification, pre-test preparation, and instrumentation. Examples are given of typical classes of vibratory behavior and their sensitivities to both engine-system variables and in-service and flight environment effects. It is illustrated that early systematic explorations of these variables are necessary to establish these sensitivities and provide adequate margins for long service life. M.G.

N81-24093# Rolls-Royce Ltd., Bristol (England). Test Operations Dept.
BENCH TESTING OF A VECTORED THRUST ENGINE
R. H. Blake *In* AGARD Turbine Engine Testing Jan. 1981 15 p (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

The history of plant development to accommodate the test program for the thrust vectored Pegasus engine is described, including the need for thrust vector measurement and exhaust gas collectors to allow nozzle swivelling without hot gas re-ingestion. The evaluation of plant effects on engine performance and the philosophy adopted for simplified production testing in the horizontal thrust mode only are described. M.G.

N81-24094# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
PERFORMANCE ASSESSMENT OF AN ADVANCED REHEATED TURBO FAN ENGINE
V. Zeidler *In* AGARD Turbine Engine Testing Jan. 1981 22 p refs (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

Various approaches to determine thrust-in-flight and other appropriaters are discussed. It is noted that the degree of specialization or simplification of some methods points to the applicability; i.e., the quick estimation of actual take off thrust with regard to safety aspects in case of single engine climb-out, requires only a simple option, which produces acceptable results even if the engine is of lower instrumentation standard. On the other hand, for inflight thrust, engine performance assessment and aircraft drag analysis is calculated by an ambitious computer program using test data of engines with a higher instrumentation standard. The influence of altitude test facility testing on the accuracy is described. M.G.

N81-24095# Centre d'Essais en Vol, Istres (France).
FLIGHT TESTS OF THE ENGINES OF COMBAT AIRCRAFT: VALIDATION METHODS USED BY CEV [LES ESSAIS EN VOL DE MOTEURS D'AVIONS DE COMBAT, METHODS DE VALIDATION EMPLOYEES PARLE CEV]
In AGARD Turbine Engine Testing Jan. 1981 6 p In FRENCH (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

Validation of series standard can be definitively obtained for the engines of combat aircraft only after flight tests. The validation tests used at CEV not only assure the good operation of motors in series under the most critical conditions of use, but also verify in flight their conformity with certain contractual and regulatory requirements. Influential parameters are listed, the conditions of use which must be the object of flight tests are inventoried, and the principles of the methods used are examined. These methods consist either of testing 'extreme' motors built with chosen or regulated elements each within tolerance limits, or by simulating the extreme configurations by appropriate control of the governors. Transl. by A.R.H.

N81-24096# Centre d'Essais des Propulseurs, Orsay (France).
TESTS OF LARGE COMPRESSORS AT CE Pr [ESSAIS DE GRANDS COMPRESSEURS AU CENTRE D'ESSAIS DES PROPULSEURS]
Ph. Ramette and J. L. Freson (Service Technique de la Production Aeronautique, Paris) *In* AGARD Turbine Engine Testing Jan. 1981 8 p In FRENCH (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

The C3 test bench at CEPr permits testing large double flow compressors whose power can reach 40,000 kW. Methods used to obtain measurements on turning parts are described as well as probes for determining pressure, temperature, and vibration. Test techniques and the use of the computer to obtain the double flow compressor fields, particularly in proximity to the pump line are examined. Transl. by A.R.H.

N81-24097# Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
FULL ANNULAR COMBUSTOR TEST FACILITY FOR HIGH PRESSURE/HIGH TEMPERATURE TESTING
G. Kirschey and R. Wagner (DFVLR, Cologne) *In* AGARD Turbine Engine Testing Jan. 1981 17 p refs (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

A combustor test facility is described which is capable of carrying out annular combustor research with up to 16 bar and 820 K combustor inlet conditions. The requirements for typical test procedures for high pressure/high temperature combustor testing are established and the layouts for the test installations and the test bed are specified. The testing and measuring techniques to achieve accurate high temperature measurement and gas analysis at the exit of the annular combustor are described in some detail. Results achieved by the testing show close similarity to those produced by engine testing. M.G.

N81-24098# Fiat Aviazione S.p.A., Turin (Italy).
LOW PRESSURE TURBINE TESTING
F. Rodi, M. Varetti, and R. Tomat *In* AGARD Turbine Engine Testing Jan. 1981 13 p refs (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

The engine performance simulation model, the basis of all engine work, is used for a reliable assessment of marketable performance for the prediction of the flight performance of the aircraft, for the interpretation of the engine malfunctioning and then for a correct evaluation of the engine growth potential. The accuracy of the engine model is a function of the quality of the performance characteristics used for each component. In accordance with this concept within a turbofan development program, a comprehensive investigation on the low pressure turbine was carried out in order to define the component performance with the best possible accuracy. Different kinds of tests are performed, from bidimensional, rotating cascades and a cold flow rig test to in engine component testing. The advantages and the intrinsic limits of each kind of test are discussed. Low pressure turbine theoretical prediction methods and a correlation between predictions and rig results are shown. Rig results are compared with the in engine ones measured with an appropriate instrumentation fitted on the engine. S.F.

N81-24099# Alfa Romeo S.p.A., Naples (Italy).
RIG INVESTIGATION OF A TWO STAGE SINGLE SHAFT LOW COST TURBINE
O. Natale, C. Sorrentino, and C. Massaro *In* AGARD Turbine Engine Testing Jan. 1981 15 p refs (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

The development program of a two stage, single shaft turbine is described. The program is based on tests performed in the single shaft two stage turbine configuration, the objective being the optimization of the off design performance, correct distribution of the first and second stage workload and harmonization of the nozzle throat areas. Tests were carried out or are planned to investigate the effect on the efficiency of the rotor tip clearance, Reynolds number effect and cooling flows. The analysis is compared with the predicted carpet of each stage individually and of the stages together. S.F.

N81-24100# Rolls-Royce Ltd., Derby (England). Mechanical Test Engineering Dept.
THE MECHANICAL TESTING OF COMPRESSORS AND

TURBINES FOR AIRCRAFT GAS TURBINE ENGINES
D. Norris *In* AGARD Turbine Engine Testing Jan. 1981 12 p (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

Mechanical tests of major rotating components, whose failure is potentially catastrophic to an aircraft, are described in relation to proving and developing the mechanical strength of endurance of the piece. The principal tests, the techniques and some of the equipment which is employed for testing compressor and turbine components are described. The work relates to approximately ten different engine types, including the RB 211 family of engines, and to both civil and military applications. S.F.

N81-24101# Costruzioni Aeronautiche Giovanni Agusta S.p.A., Gallarate (Italy).
HELICOPTER TRANSMISSION QUALIFICATION PROCEDURES AND TESTS
A. Garavaglia and G. Gattinoni *In* AGARD Turbine Engine Testing Jan. 1981 10 p (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

The tests required to qualify helicopter transmission in conformity with the current civil and military requirements, the tests to be conducted for initial development and prequalification as the tests essential to guarantee a satisfactory maturity of the product being released for service are detailed. The features of each test technique and their significance under the various phases of the program are described. The use of ground test vehicles and intensive flight testing are pointed out with particular emphasis. S.F.

N81-24102# Naval Air Propulsion Test Center, Trenton, N.J.
HELICOPTER TRANSMISSION TESTING
Pasquale J. Mangione *In* AGARD Turbine Engine Testing Jan. 1981 34 p refs (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

Helicopter propulsion system evaluation testing is conducted on individual components in the early stages of development. The total propulsion system is not operationally tested until the components are installed in the first aircraft. As such, dynamic interface problems are not detected until this stage of the full scale development program which proves costly. To achieve more development/reliability testing and more meaningful qualification tests of the total system, the Naval Air Propulsion Center, under Naval Air Systems Command sponsorship, developed the only indoor facility in the United States capable of testing a rotorless helicopter propulsion system. The test facility is described and the rationale and capability of an integrated, dynamic test stand for total system testing is presented. S.F.

N81-24103# Societe Microturbo, Toulouse (France).
DEVELOPMENT TESTS OF AN ENGINE WITH LIMITED LIFE [ESSAIS DE DEVELOPMENT DE MOTEUR A DUREE DE VIE LIMITEE]
In AGARD Turbine Engine Testing Jan. 1981 7 p In FRENCH (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

A propulsion system with short engine life must have mass and surface thrust and a specific consumption while remaining simple in design to assure low production costs. To these qualities are added ease of integration into the airframe (increased coefficient of distortion of the air inlet, concentrated equipment, simple general shape) and a firm hold in the face of environmental influences. Development and production qualification tests are very different from those performed on piloted aircraft engines. The prinicipal tests conducted on the MICRO-TURBO TRI 60 turbojet engine during four programs for adapting the engine to pilotless vehicles are presented. Possible solutions to obtain low production cost are indicated. Transl. by A.R.H.

N81-24104# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
PREDICTION OF FUTURE TEST NEEDS, TEST FACILITIES AND PROCEDURES
Eric E. Abell *In* AGARD Turbine Engine Testing Jan. 1981 4 p (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

The requirements for future military turbine engine testing reflect a more reasonable balance between the types of validation necessary to provide satisfactory operational weapon systems. In the past a large emphasis was placed on aerodynamic and thermodynamic aspects of the engine. Durability and reliability tended to be assigned lesser priority. This situation led to problems and failures of engines in operational service. A re-examination was conducted by the USAF of the type and methods associated with qualification of military gas turbine engines. During this examination it became evident that re-emphasis on the durability aspects of the engine was necessary. S.F.

N81-24105# Politecnico di Milano (Italy).
DEVELOPMENT FOR NEW LABORATORIES FOR FUTURE TESTING
Corrado Casci *In* AGARD Turbine Engine Testing Jan. 1981 28 p refs (For primary document see N81-24071 15-07)
Avail: NTIS HC A21/MF A01

Three fundamental characteristics of aerospace systems are weight, volume, and power. Considering the use of the propeller (military or civil), two other economic factors are taken into consideration: the lowest possible obsoleteness for military use and the lowest cost of utilization for civil use. Themes of theoretical and experimental research are: (1) about the components relative to only the energetic system: subsonic and supersonic combustion processes; traditional and nontraditional combustibles; interaction between the mechanical and combustible system; with combustion in axial fluxes and deviated fluxes: spark ignition; initial combustion and relative phenomena; transitory of the combustion; the combustion regime; (2) of the fluid-dynamic system components: isolated blades of the compressor and turbine with a small rapport in subsonic and supersonic fluxes; elevated load blades in subsonic and supersonic fluxes; annular formation of the compressor and turbine; and (3) electronically servo-assisted automation during the transitory phase of any process. S.F.

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N81-24106* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
VELOCITY VECTOR CONTROL SYSTEM AUGMENTED WITH DIRECT LIFT CONTROL Patent
Henry F. Tisdale, Sr. (Tisdale (Henry F., Sr.), Treasure Island, Fla.) and Wendell W. Kelly, inventors (to NASA) (Tisdale (Henry F., Sr), Treasure Island, Fla.) Issued 14 Apr. 1981 6 p Filed 28 Feb. 1979 Supersedes N79-20136 (17 - 11, p 1394) Sponsored by NASA
(NASA-Case-LAR-12268-1; US-Patent-4,261,537; US-Patent-Appl-SN-015996; US-Patent-Class-244-181; US-Patent-Class-244-195; US-Patent-Class-318-584; US-Patent-Class-364-434) Avail: US Patent and Trademark Office CSCL 01C

A pilot-controlled stability control system that employs direct lift control (spoiler control) with elevator control to control the flight path angle of an aircraft is described. A computer on the aircraft generates an elevator control signal and a spoiler control signal, using a pilot-controlled pitch control signal and pitch rate, vertical velocity, roll angle, groundspeed, engine pressure ratio and vertical acceleration signals which are generated on the aircraft. The direct lift control by the aircraft spoilers improves the response of the aircraft flight path angle and provides short term flight path stabilization against environmental disturbances.
Official Gazette of the U.S. Patent and Trademark Office

N81-24107# Council for Scientific and Industrial Research, Pretoria (South Africa).
THE STICK-FIXED LATERAL DYNAMIC STABILITY OF THE CSIR SARA II AUTOGYRO
R. A. Streather Jun. 1980 32 p refs
(NIAST-80/52) Avail: NTIS HC A03/MF A01

The analysis is based on that of the helicopter in autorotation.

It is shown that the autogyro is stable in all three conventional modes of motion over the speed range from 15 to 45 m/s and for a center of gravity up to 0.3 m aft of the normal operating position. T.M.

N81-24108# Boeing Vertol Co., Philadelphia, Pa.
ADVANCED SCOUT HELICOPTER (ASH) FLY-BY-WIRE CONTROL SYSTEM PRELIMINARY DESIGN. VOLUME 1: SYSTEM DESIGN AND ANALYSIS Final Report, Mar. 1979 - Mar. 1980
Bruce L. McManus and Kenneth H. Landis Ft. Eustis, Va. Army Research and Technology Labs. Mar. 1981 153 p refs
(Contract DAAK51-79-C-0008; DA Proj. 1X4-64203-D-281)
(AD-A098155; D210-11560-1-Vol-1; USAAVRADCOM-TR-81-D-9A) Avail: NTIS HC A08/MF A01 CSCL 01/3

This preliminary design study was conducted to assess the payoffs in applying fly-by-wire and other advanced flight control concepts to the anticipated Advanced Scout Helicopter (ASH). The study compares the advanced concept systems with a dual mechanical flight control system in the following areas: handling qualities, reliability, maintainability, availability, durability, survivability, EMP/EMI/lightning tolerance, cost, and weight. The candidate vehicle for the study was the Medium Utility Transport (MUT) as defined in document USAAMRDL-TR-75-56A (gross weight 9,544 lb and useful payload 960 lb). The selected fly-by-optics and fly-by-wire candidates employ triplex in-line monitoring for primary controls and triplex cross-channel monitoring for augmentation functions. Both use of a two-axis sidearm force controller with separate collective pitch controls and directional pedals. Processing is digital, using 16-bit microprocessors. A multiprocessor approach is defined to provide hardware separation of the flight-critical primary control functions from noncritical automatic control functions. Rotor control actuators are of an integrated design having triplex electrical control elements with a dual hydromechanical output stage. Both candidates were found to be superior to the dual mechanical system in most respects. The fly-by-optics has a further advantage over the fly-by-wire in EMP/EMI/lighting tolerance, maintainability, and availability. Production acquisition and operation/maintenance costs are similar for all candidates. Further development of fiber optic transducers and interfacing hardware is required to reduce risk for the fly-by-optics candidate. GRA

N81-24109# Bristol Univ. (England). Dept. of Aeronautical Engineering.
PITCH-FLAP-PHASE COUPLING. A PRELIMINARY ANALYSIS OF AN EVOLVING CONCEPT OF HELICOPTER AUTOSTABILIZATION B.S. Thesis
S. M. Bourne and W. Y. F. Chan Jun. 1980 90 p refs
(BU-242) Avail: NTIS HC A05/MF A01

A six degree of freedom model of helicopter dynamics is presented based on Newtonian mechanics, with the acceptance of quasi-steady rotor forces and moments referred to the flight state invariant shaft axis reference system. Use of the classical small disturbance theory allows linearization, while partial differentiation furnishes all rotor forces, moments and state derivatives. The modification of rotor state derivatives with introduction of pitch-flap-phase coupling is presented. Modal analysis is effected primarily longitudinally, based on a weakly coupled systems hypothesis necessitated by low directional stability attributable to tail rotor omission. Overall asymptotic longitudinal stability of the system is achieved, subject to a future rotor stability analysis, a precondition being the reversal of the natural rotor derivatives by use of sufficient negative pitch-flap coupling. Phase lag/lead of 170-190 deg and -0.5 coupling gain infers maximum positive damping, typically 20 sec to half amplitude in the most weakly damped mode, ensuring at the same time the maintenance of the control derivatives at the desired unity level. Author (ESA)

N81-24110# Societe Nationale Industrielle Aerospatiale, Toulouse (France).
TOTAL ENERGY AND FLIGHT CONTROL [ENERGIE TOTALE ET CONDUITE DU VOL]
B. Jacquot Paris 11 Apr. 1980 17 p In FRENCH Presented at ENAC Seminaire Evolution des Systemes de Bord, Toulouse, 24-28 Mar. 1980
(SNIAS-802-111-102; AERO-454.017/80) Avail: NTIS HC A02/MF A01

Application of the concept of total energy in maintaining a trajectory, constant airspeed, or both, is modeled in vector form. Total energy is defined as the relationship between aircraft mass, velocity, and the acceleration of gravity in function of aircraft altitude. Achieving constant airspeed, whether independently or as an interaction of trajectory and velocity, is considered. Manual piloting, automatic piloting, and a combined manual/automatic system in the presence of variable wind (wind gradients problem) are treated. Results point to the advantages of having total energy feedback through cockpit instrumentation. Author (ESA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N81-24111*# Embry-Riddle Aeronautical Univ., Daytona Beach, Fla. Aviation Research Center.
A PILOT TRAINING MANUAL FOR THE TERMINAL CONFIGURED VEHICLE ELECTRONIC ATTITUDE DIRECTOR INDICATOR
Jules Gandelman Jan. 1980 92 p refs
(Contract NAS1-15724)
(NASA-CR-159195) Avail: NTIS HC A05/MF A01 CSCL 14B

A hard copy version is presented of a 28-minute, 90 slide audiovisual program which provides the basic instructional format for introduction to the terminal configured vehicle electronic attitude director indicator (EADI) and the strategy for learning the symbols used on the EADI and their interpretation. The basic strategy is to start with known symbols and then introduce all new symbols with emphasis appropriate to their complexity and frequency of use. The upper half of each page of the manual contains a reproduction of the slide. The text associated with the slide is found on the lower half of each page and is recorded on audio tape. A.R.H.

N81-24112*# Systems and Applied Sciences Corp., Hampton, Va.
AN EXPERIMENTAL INVESTIGATION OF A LARGE DELTA P SETTLING CHAMBER FOR A SUPERSONIC PILOT QUIET TUNNEL Final Report
Michael Piatt Washington NASA Jun. 1981 81 p refs
(Contract NAS1-16096)
(NASA-CR-3436; R-SAL-03/81-03) Avail: NTIS HC A05/MF A01 CSCL 14B

The mean streamwise flow distributions and turbulence levels across the chamber were measured with a hot wire anemometer downstream of a series of porous Rigimesh plates which were shown to be an effective means of reducing the chamber acoustic disturbance levels due to upstream pipe and valve systems. Tests made with various types of flow conditioners downstream of the porous plates showed that a series of screens was the most effective means of achieving the objective of a uniform mean flow distribution with reduced vorticity levels downstream of the porous components. Frequency spectra obtained across the series of screens show that they reduce vorticity over a wide frequency range for several different initial upstream vorticity conditions. Improvements in the mechanical installation of the porous plates and damping screens and the use of porous plates with more uniform porosity should reduce the freestream velocity fluctuations to the minimum acoustic levels of about 0.5 percent. T.M.

N81-24113*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LASER VELOCIMETER (AUTOCOVARIANCE) BUFFER INTERFACE

James I. Clemmons, Jr. May 1981 23 p refs
(NASA-TM-83110; L-14331) Avail: NTIS HC A02/MF A01 CSCL 14B

A laser velocimeter (autocovariance) buffer interface (LVABI) was developed to serve as the interface between three laser velocimeter high speed burst counters and a minicomputer. A functional description is presented of the instrument and its unique features which allow the studies of flow velocity vector analysis, turbulence power spectra, and conditional sampling of other phenomena. Typical applications of the laser velocimeter using the LVABI are presented to illustrate its various capabilities.
E.D.K.

N81-24114*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EVALUATION OF TURBULENCE REDUCTION DEVICES FOR THE LANGLEY 8-FOOT TRANSONIC PRESSURE TUNNEL
Marion O. McKinney and James Scheiman Jun. 1981 33 p refs
(NASA-TM-81792; L-14108) Avail: NTIS HC A03/MF A01 CSCL 14B

The device test model consisted of a cooler, turning vanes, and settling chamber (immediately upstream of the contraction) in which various combinations of screens and honeycomb were tested. Conventional hot wires were used to measure the axial and lateral turbulence reduction for the different turbulence reduction devices. The final configuration chosen consisted of a honeycomb followed by five screens. T.M.

N81-24115*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ESTIMATION OF FAN PRESSURE RATIO REQUIREMENTS AND OPERATING PERFORMANCE FOR THE NATIONAL TRANSONIC FACILITY
Blair B. Gloss and Donna Nystrom May 1981 34 p refs
(NASA-TM-81802; L-14344) Avail: NTIS HC A03/MF A01 CSCL 14B

The National Transonic Facility (NTF), a fan-driven, transonic, pressurized, cryogenic wind tunnel, will operate over the Mach number range of 0.10 to 1.20 with stagnation pressures varying from 1.00 to about 8.8 atm and stagnation temperatures varying from 77 to 340 K. The NTF is cooled to cryogenic temperatures by the injection of liquid nitrogen into the tunnel stream with gaseous nitrogen as the test gas. The NTF can also operate at ambient temperatures using a conventional chilled water heat exchanger with air on nitrogen as the test gas. The methods used in estimating the fan pressure ratio requirements are described. The estimated NTF operating envelopes at Mach numbers from 0.10 to 1.20 are presented. T.M.

N81-24116# Council for Scientific and Industrial Research, Pretoria (South Africa).
PRELIMINARY CALIBRATION OF THE TRANSONIC TEST SECTION OF THE NIAST TRISONIC TUNNEL
R. A. Streather Feb. 1981 31 p refs
(NIAST-80/19) Avail: NTIS HC A03/MF A01

Wall and center line static pressure measurements show reasonable agreement with earlier calibrations of the perforated transonic test section of the trisonic blowdown tunnel. Longitudinal Mach number distributions are found to be acceptable having a variation of + or - 0,0025 subsonically and + or - 0,005 supersonically over the test section length. Control of a Mach scan in the transonic range Mach 0.8 to 1.2 is found to be most easily achieved by variation of the settling chamber stagnation pressure at fixed second throat setting and auxiliary suction compressor by pass valve opening. Transonic drag measurements made in the perforated test section on an ogive cylinder body show discrepancies with measurements made in the closed test section and with empirical results. An explanation of these discrepancies was not found and further calibration of the transonic test section is recommended. Author

N81-24117# Naval Ship Research and Development Center, Bethesda, Md. Ship Performance Dept.
ELECTROMECHANICAL OSCILLATOR FOR PRODUCING VERTICAL, HORIZONTAL, OR CIRCULAR MOTION IN A VERTICAL PLANE
John H. Pattison and Gene M. Wilburn Mar. 1981 36 p ref
(WU1548073)
(AD-A097934; DTNSRDC/SPD-0952-01) Avail: NTIS HC A03/MF A01 CSCL 14/2

An electromechanical oscillator was developed to simulate both surface-wave-induced motions and subsurface currents for the evaluation of current meters or other sensors that are suspended beneath surface buoys used in oceanographic operations. The oscillator will permit evaluating the hydrodynamic characteristics and performance of sensors under simulated sea conditions at amplitudes up to 4 ft (1.2 m) paek-to-peak and at periods from 3 to 30 s. Mechanical and operational details are described for each of three modes of operation producing circular, vertical, and horizontal motions. Sample experimental results are presented to illustrate the quality of motion in all three modes.
GRA

N81-24118# Federal Aviation Administration, Washington, D.C. Systems Research and Development Service.
HIGH SPEED EXIT TAXIWAYS Final Report
Feb. 1981 48 p refs
(AD-A098178; FAA-RD-81-16; ARD-500) Avail: NTIS HC A03/MF A01 CSCL 01/5

The 'high speed' runway exit, also known as angled exit, is an airport/airside design feature which can make an important contribution to increasing capacity of the national air transportation system. The present standard angle exit offers a safe and clear reduction in landing time on the runway. However, except in a very few instances, this potential is not realized. Low utilization of high speed exits, although not conclusively shown, appears to be the results of operational use only where and when need exists to expedite runway clearance. Underutilization also appears to be motivated by desire to avoid any unnecessary risk or passenger discomfort. Realization of the capacity improvement potential of high speed exits is controlled by the character of the approach control system and the operating procedures currently used by pilots and controllers. Both the average and scatter of current interarrival intervals are sufficiently large to prevent any further benefits from reduced runway time.
Author (GRA)

N81-24119# Oxford Univ. (England). Dept. of Engineering Science.
A DISCUSSION DOCUMENT ON THE THERMAL DESIGN OF FORCE BALANCES FOR CRYOGENIC WIND TUNNELS
W. B. Bald Mar. 1980 41 p refs
(Contract AT/2057/072/XR/AERO)
(OUEL-1321/80) Avail: NTIS HC A03/MF A01

The design performance, and theory of unheated and heated balances are reviewed. As extensive strain gage calibration is necessary for unheated balances, they are not considered as favorable as heated ones. Five heaters are utilized in the heated balance arrangement proposed. Their role is to compensate for conductive losses and to prevent and minimize convective losses. Finite element techniques are employed, details being given about the appropriate computer packages. The results of preliminary temperature measurements made on a TEM 1004/101 half balance are given, the outputs from the thermocouples used being fed via simple conditioning amplifiers into a U.V. recorder. The results indicate that further work is necessary to optimize design and performance. Author (ESA)

N81-24120# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
WIND TUNNEL CORRECTIONS FOR HIGH ANGLE OF ATTACK MODELS
R. O. Dietz, ed. and M. L. Laster, ed. Feb. 1981 120 p refs In ENGLISH and FRENCH
(AGARD-R-692; ISBN-92-835-0283-3) Avail: NTIS HC A06/MF A01

Several wind tunnel wall correction methods in use or under study are presented for closed, open, and ventilated wall wind tunnels. The Mach number range is generally limited up to high subsonic speeds with some techniques only useful for incompressible flow. Wall correction techniques discussed along with their attributes and disadvantages include vortex lattice, panel, system of images, wall pressure, and adaptive walls. The adaptive wall technique is a method to actively reduce or eliminate the need for wall correction and is becoming more favorable as

development problems are solved. For individual titles, see N81-24121 through N81-24127.

N81-24121# National Aeronautical Establishment, Ottawa (Ontario).
CANADIAN STUDIES OF WIND TUNNEL CORRECTIONS FOR HIGH ANGLE OF ATTACK MODELS
M. Mokry *In* AGARD Wind Tunnel Corrections for High Angle of Attack Models Feb. 1981 11 p refs (For primary document see N81-24120 15-09)
Avail: NTIS HC A06/MF A01

Wind tunnel interference studies relating to testing of high angle of attack models carried out in Canada during the last decade are briefly reviewed. A test section was developed which produces adequately low corrections to test data for a wide range of sizes, shapes, and angles of attack of test airfoil. E.D.K.

N81-24122*# Lockheed-Georgia Co., Marietta.
A REVIEW OF THE WALL PRESSURE SIGNATURE AND OTHER TUNNEL CONSTRAINT CORRECTION METHODS FOR HIGH ANGLE-OF-ATTACK TESTS
J. E. Hackett, D. J. Wilsden, and W. A. Stevens *In* AGARD Wind Tunnel Corrections for High Angle of Attack Models Feb. 1981 16 p refs (For primary document see N81-24120 15-09) (Contract NAS2-9883)
Avail: NTIS HC A06/MF A01 CSCL 14B

Recent developments concerning correction techniques for high angle of attack testing are reviewed and the results are presented of a letter survey on the methods now in use. The application of the wall pressure signature technique is demonstrated in experiments on several types of models. The method is shown to provide good estimates of tunnel blockage effects and extension to lift interference is discussed. It appears that correctability is limited more by the problem of determining the effects of tunnel induced velocity gradients than by ability to determine the flow field. It is suggested that passive boundary measurement technology diffuses first into high angle of attack production testing, possibly followed by partially adaptive tunnel techniques. E.D.K.

N81-24123# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
EXPECTED IMPROVEMENTS ON HIGH ANGLE OF ATTACK MODEL TESTING
Xavier Vaucheret *In* AGARD Wind Tunnel Corrections for High Angle of Attack Models Feb. 1981 22 p refs In FRENCH; ENGLISH summary (For primary document see N81-24120 15-09)
Avail: NTIS HC A06/MF A01

Problems encountered during tests at high angle of attack in wind tunnels are: wall interference, sting interference, and vibrations beyond the stall. The state of the art on wall interference systematically applied to the development tests is shown with several comparisons between wind tunnels or between flight and tunnels tests. The models used in unconfined flow point out some deficiencies as regards apex vortex and active jets. The control of the validity of the wall interference correction method is analyzed. E.D.K.

N81-24124# Aerodynamische Versuchsanstalt, Goettingen (West Germany).
GERMAN ACTIVITIES ON WIND TUNNEL CORRECTIONS
H. Holst *In* AGARD Wind Tunnel Corrections for High Angle of Attack Models Feb. 1981 23 p refs (For primary document see N81-24120 15-09)
Avail: NTIS HC A06/MF A01

Wind tunnel interference factors were calculated for open, closed, slotted, and perforated walls using the vortex lattice method with a homogeneous boundary condition. A more realistic pitching moment correction is obtained when the lift dependent relocation of the trailing vortices is taken into account. The inhomogeneities of lift and blockade interference parameters throughout the test section were investigated for models large in comparison to the test section dimensions. A method was developed using measured wall pressures for the correction of drag in transonic wind tunnels. For closed test sections, the image method and a modified vortex lattice method were used to evaluate wall pressure signals for correction purposes. E.D.K.

N81-24125# National Aerospace Lab., Amsterdam (Netherlands).
A REVIEW OF RESEARCH AT NLR ON WIND-TUNNEL CORRECTIONS FOR HIGH ANGLE OF ATTACK MODELS
R. A. Maarsingh *In* AGARD Wind Tunnel Corrections for High Angle of Attack Models Feb. 1981 11 p refs (For primary document see N81-24120 15-09)
Avail: NTIS HC A06/MF A01

A survey is given of past, current, and planned work at NLR in the field of wind tunnel wall interference on models at high angles of attack at low subsonic speeds. Among long term research activities those concerning alotted wall test sections play a dominant part. It is felt that an approach which makes use of measured distributions of flow quantities near the walls is the most promising one. It may be recommended also as a short term solution for some special wall correction problems arising from modern low speed wind tunnel testing in closed test sections. E.D.K.

N81-24126# Aeronautical Research Inst. of Sweden, Bromma.
A REVIEW OF SOME INVESTIGATIONS ON WIND TUNNEL WALL INTERFERENCE CARRIED OUT IN SWEDEN IN RECENT YEARS
S-E. Nyberg *In* AGARD Wind Tunnel Corrections for High Angle of Attack Models Feb. 1981 19 p refs (For primary document see N81-24120 15-09)
Avail: NTIS HC A06/MF A01

For subsonic incompressible flow the mutual circulation induced model wind tunnel interference was calculated by panel methods for large multicomponent two dimensional airfoils, for three dimensional swept wings, full or half models, and for wing-tail configurations. Wake blockage effects from a swept wing with and without high lift devices were studied experimentally. The effects of air flow leakage between half model fuselage and reflection wall were investigated. For transonic flow the flow properties of slotted walls and the influence of wall boundary layer were studied. Based on these results a numerical method was developed and so far axisymmetric calculations were carried out. The results were compared with experimental results for large blockage models. E.D.K.

N81-24127# Queen Mary Coll., London (England).
WIND TUNNEL CORRECTIONS FOR HIGH ANGLES OF ATTACK: A BRIEF REVIEW OF RECENT UK WORK
A. D. Young *In* AGARD Wind Tunnel Corrections for High Angle of Attack Models Feb. 1981 11 p refs (For primary document see N81-24120 15-09)
Avail: NTIS HC A06/MF A01

The use of adaptive walls, a panel method of model and wake representation for a two dimensional model in a wind tunnel with solid walls, the use of measured pressure distributions on tunnel floor and roof also for a two dimensional model and solid walls, a vortex lattice representation of the tunnel walls to take account of wake curvature, interference limitations on tests on V/STOL models with lifting jets, and work on blockage corrections on models with reverse thrust are discussed. Some discussion is offered on the limitations on the validity of current methods for determining wind tunnel corrections and it is argued that these limitations are least severe with the use of adaptive walls. E.D.K.

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N81-24128*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PROCEEDINGS OF THE SHUTTLE-BASED COMETARY SCIENCE WORKSHOP: A FORUM FOR THE PRESENTATION AND DISCUSSION OF POSSIBLE SHUTTLE-BASED EXPERIMENTS AND OBSERVATIONS OF COMETS AND COMETARY-LIKE MATERIALS
G. Allen Gary, ed. and K. Stuart Clifton, ed. 1976 259 p refs Workshop held at Huntsville, Ala., 4-5 Nov. 1976 Prepared in cooperation with Alabama Univ. in Huntsville
(Contract NAS8-32225)

(NASA-TM-82317) Avail: NTIS HC A12/MF A01 CSCL 22A

The prospects of cometary research from the space shuttle are examined. Topics include: the shuttle as research environment; on-board experiments at zero-gravity and release of gas and dust to simulate cometary phenomena; and cometary observations from space. For individual titles, see N81-24129 through N81-24144.

N81-24129*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SPACE SHUTTLE OPPORTUNITIES FOR COMETARY RESEARCH

Charles A. Lundquist *In its* Proc. of the Shuttle-Based Cometary Sci. Workshop 1976 p 5-6 (For primary document see N81-24128 15-12)

Avail: NTIS HC A12/MF A01 CSCL 22A

The different modes of cometary investigation offered by the shuttle are reviewed. First, there is a mode in which instrumentation for observations of a natural comet is carried to orbit on Spacelab. Second is a mode in which gaseous or solid material is released from the shuttle to simulate some aspect of cometary physics. Another mode uses the near weightlessness within Spacelab to allow laboratory experiments with materials as they may exist on the surface of a comet nucleus. E.D.K.

N81-24130*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SHUTTLE/SPACELAB DESIGN, PERFORMANCE, ACCOMMODATIONS AND CONSTRAINTS **c16**

In its Proc. of the Shuttle-Based Cometary Sci. Workshop 1976 p 7-91 (For primary document see N81-24128 15-12)

Avail: NTIS HC A12/MF A01 CSCL 22B

The main characteristics of the Shuttle/Spacelab system are described in order to provide an introduction for individual experimenters who may propose cometary science experiments. The information was derived from the 'Spacelab Payload Accommodations Handbook PDR-B 1976'. Specific information is subject to change; however, the salient design, performance, accommodations, and constraints for the experimenter are expected to remain as presented. E.D.K.

N81-24131*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

A LOW LIGHT LEVEL TELEVISION SYSTEM **c74**

B. J. Duncan *In its* Proc. of the Shuttle-Based Cometary Sci. Workshop 1976 p 93-93 (For primary document see N81-24128 15-12)

Avail: NTIS HC A12/MF A01 CSCL 20F

A proposal was submitted in response to the announcement of opportunities for Skylab 1 involving low light level imaging techniques. While the observational objectives are not necessarily pertinent to cometary experimentation and observation the instrumentation possibly would be, and is potentially available if the proposal is successful. The proposed observations are of natural and induced atmospheric glows and near vehicle aerosol distribution. E.D.K.

N81-24132*# Toledo Univ., Ohio. Dept. of Physics and Astronomy.

SIMULATION OF A COMETARY CONGLOMERATE OF FROZEN GASES AND DUST IN A ZERO-GRAVITY ENVIRONMENT: A CRITICAL EVALUATION OF POSSIBLE SPACE EXPERIMENTS

A. H. Delsemme *In* NASA. Marshall Space Flight Center Proc. of the Shuttle-Based Cometary Sci. Workshop 1976 p 99-117 refs (For primary document see N81-24128 15-12)

Avail: NTIS HC A12/MF A01 CSCL 22A

It is proposed to use the Shuttle (OFT experiments) or eventually Spacelab to study, in the absence of gravity the low velocity accretion and the bulk properties of icy conglomerates simulating cometary material and their sedimentation and bulk properties in very small acceleration fields. Their behavior when exposed to the direct solar flux is also under consideration. E.D.K.

N81-24133*# Howard Univ., Washington, D. C. Dept. of Chemistry.

SOLAR PHOTOCHEMISTRY USING THE SPACE SHUTTLE

William M. Jackson and Joshua Halpern *In* NASA. Marshall Space Flight Center Proc. of the Shuttle-Based Cometary Sci. Workshop 1976 p 118-136 refs (For primary document see N81-24128 15-12)

Avail: NTIS HC A12/MF A01 CSCL 22A

A continuing source of difficulty in cometary astrophysics is understanding the origin of C2, C3, NH and CO(+) species in comets. An experiment is proposed to investigate these problems by continuously releasing suspected parent gases from the space shuttle and using a dye laser to selectively excite fragments produced as a result of solar photochemical decomposition of the molecules. The backscattered fluorescence is gathered by a telescope, spectrally filtered, and measured as a function of time after the laser pulse. E.D.K.

N81-24134*# Los Alamos Scientific Lab., N. Mex. Theoretical Div.

COMETARY NUCLEUS RELEASE EXPERIMENTS AND ICE PHYSICS

W. F. Huebner *In* NASA. Marshall Space Flight Center Proc. of the Shuttle-Based Cometary Sci. Workshop 1976 p 137-141 refs (For primary document see N81-24128 15-12)

Avail: NTIS HC A12/MF A01 CSCL 22A

Some physical and chemical processes involved in the evaporation and sublimation of mixtures of frozen gases are discussed. Effects of zero gravity, vacuum, and solar radiation are emphasized. Relevant experiments that can be carried out with the aid of the space shuttle are proposed. E.D.K.

N81-24135*# Smithsonian Astrophysical Observatory, Cambridge, Mass.

DUST CONTENT AND PARTICLE RELEASE EXPERIMENTS

Zdenek Sekanina *In* NASA. Marshall Space Flight Center Proc. of the Shuttle-Based Cometary Sci. Workshop 1976 p 142-149 refs (For primary document see N81-24128 15-12)

(Grant NGR-09-015-159)

Avail: NTIS HC A12/MF A01 CSCL 22A

Since dust particles are carried away from a comet nucleus by sublimating ices the effects from the ambient Earth's atmosphere on shuttle-based simulation experiments at lower altitudes are of the same concern to the studies of the dust behavior as they are to the investigation of the volatile component. Also, since the experimental modeling could realistically be performed on a linear scale that is at least three orders of magnitude smaller than required by the true conditions in comets, severe problems of extrapolation may arise in the interpretation of some of the simulation results. Subject to these limitations, future dust-release experiments made on artificial comets could prove fruitful, as they would test the correctness of the understanding of the fundamental properties of the dust emission mechanism in comets, and at the same time insight into the behavior of dust particles after expulsion would be gained. E.D.K.

N81-24136*# Herzberg Inst. of Astrophysics, Ottawa (Ontario).

SPECTROSCOPY OF SMALL COMETARY PARTICLES

Peter M. Millman *In* NASA. Marshall Space Flight Center Proc. of the Shuttle-Based Cometary Sci. Workshop 1976 p 150-159 refs (For primary document see N81-24128 15-12)

Avail: NTIS HC A12/MF A01 CSCL 22A

Knowledge of chemical composition derived from the spectroscopy of small cometary meteoroids when they enter the Earth's atmosphere at high velocity and become visible as meteors is briefly summarized. For statistically reliable results it is necessary to have a large number of observations and this requires the photography of relatively faint meteors, which are considerably more numerous than the bright fireballs. The improvement in observational techniques and cameras has made it possible to extend the range of spectrographic data from cometary particles of mass between a kilogram and a gram down to those of only 0.01 or 0.001 grams in mass. The corresponding increase in the number-value of the statistics was from less than 100 data points to several 1000. E.D.K.

N81-24137*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

REVIEW COMMENTS OF SHUTTLE-BASED COMETARY EXPERIMENTS
C. R. ODell *In its* Proc. of the Shuttle-Based Cometary Sci. Workshop 1976 p 160-166 (For primary document see N81-24128 15-12)
Avail: NTIS HC A12/MF A01 CSCL 22A

The experiments considered are in two groups: on-board experiments and overboard experiments. The on-board experiments include the determination of bulk properties and processes (within solids) and observations of exposure panels (near surface phenomena) The overboard experiments consist of analysis of gas/dust shells by observation from the shuttle and observation by sub-satellites. Experimental parameters are discussed with emphasis on work that is unique to low gravity and high vacuum environments. T.M.

N81-24138*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE STATUS OF COMETARY SCIENCE c91
Fred L. Whipple *In* NASA. Marshall Space Flight Center Proc. of the Shuttle-Based Cometary Sci. Workshop 1976 p 169-190 refs (For primary document see N81-24128 15-12)
(Grant NsG-7082)
Avail: NTIS HC A12/MF A01 CSCL 03B

The problem of determining the chemical composition and physical structure of comet nuclei are discussed in light of recent analytical improvements. The development of radio and infrared techniques, improved sensing equipment, and the ability to conduct observations in space using satellites or skylabs are highlighted. The studies of two major comets, Kohoutek and West 1975n, are presented as examples of the utilization of these improved analytic tools. T.M.

N81-24139*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SHUTTLE-BASED OBSERVATIONS
M. Dubin *In* NASA. Marshall Space Flight Center Proc. of the Shuttle-Based Cometary Sci. Workshop 1976 p 193-197 (For primary document see N81-24128 15-12)
Avail: NTIS HC A12/MF A01 CSCL 22A

Progress in science in relation to the space shuttle is reported. Several studies on the uses of the space shuttle and Spacelab are highlighted. A review of the activities of the Shuttle Spacelab Payloads Project Office are presented. The activities cover such fields as solar physics, astronomy with optical instruments, high energy astrophysics, atmospheric research and magnetospheric physics, and Earth observational studies. T.M.

N81-24140*# Colorado Univ. at Boulder.
ULTRAVIOLET SPECTROSCOPY OF COMETS c91
Charles F. Lillie *In* NASA. Marshall Space Flight Center Proc. of the Shuttle-Based Cometary Sci. Workshop 1976 p 205-221 refs (For primary document see N81-24128 15-12)
Avail: NTIS HC A12/MF A01 CSCL 03B

The advantages of the space shuttle being used as an observing platform with advanced instrumentation for the study of comets are discussed. The ground-based observations of the comet West (1976) were used to illustrate the many problems caused by the Earth's atmosphere. The spectrum of comet Bennett (1970 II) was compared to that the of comet West in order to correct instrument errors. T.M.

N81-24141*# Centre National de la Recherche Scientifique, Verrieres-le-Buisson (France). Service d'Aeronomie.
OH OBSERVATIONS c91
Michel Festou *In* NASA. Marshall Space Flight Center Proc. of the Shuttle-Based Cometary Sci. Workshop 1976 p 222-226 refs (For primary document see N81-24128 15-12)
Avail: NTIS HC A12/MF A01 CSCL 03B

A model of the dissociative lifetime of the hydroxyl radical is computed where the H2O and OH velocities are vectorially added. A lifetime of approximately 3 x 100,000 seconds is determined. S.F.

N81-24142*# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
HYDROGEN LYMAN ALPHA OBSERVATIONS c91
H. U. Keller *In* NASA. Marshall Space Flight Center Proc. of the Shuttle-Based Cometary Sci. Workshop 1976 p 227-237 refs (For primary document see N81-24128 15-12)
Avail: NTIS HC A12/MF A01 CSCL 03B

Cometary Lyman alpha observations are interpreted, with focus on the hydrogen halo. It is concluded that H2O is the dominant parent molecule of the observed hydrogen. Hydrogen (H) and OH are produced in a ratio of approximately 2 to 1. S.F.

N81-24143*# California Univ., San Diego, La Jolla. Dept. of Applied Physics and Information Science.
THE STUDY OF COMETARY PLASMAS USING ARTIFICIAL COMETS LAUNCHED FROM THE SPACE SHUTTLE c91
D. A. Mendis *In* NASA. Marshall Space Flight Center Proc. of the Shuttle-Based Cometary Sci. Workshop 1976 p 238-248 refs (For primary document see N81-24128 15-12)
(Grants NsG-7102; NGR-05-009-110; NSF MPS-74-23501; NSF MPS-74-21195)
Avail: NTIS HC A12/MF A01 CSCL 03B

The agents responsible for observed (transient) cometary phenomena are solar radiation and solar wind. The evaporation of cometary snows and the dissociation and ionization of the resulting gas molecules are discussed. S.F.

N81-24144*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE HALLEY RENDEZVOUS VIA SOLAR SAILING MISSION DESCRIPTION c91
L. D. Friedman *In its* Proc. of the Shuttle-Based Cometary Sci. Workshop 1976 p 251-256 (For primary document see N81-24128 15-12)
Avail: NTIS HC A12/MF A01 CSCL 03B

The possibility of using solar sails to achieve a rendezvous with Halley's Comet is explored. Rendezvous trajectories are calculated. S.F.

N81-24145*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex. Structures and Mechanics Div.
COMPUTER PROGRAM DOCUMENTATION USER INFORMATION FOR THE MPAD TRAJECTORY TAPE PRINT PROGRAM (TRJPR1)
P. M. Gibbs Feb. 1981 30 p refs
(Contract NAS9-15800)
(NASA-CR-160960; JSC-17240; LEMSCO-16307) Avail: NTIS HC A03/MF A01 CSCL 22A

The Trajectory Tape Print Program (TRJPR1) was developed to print applicable information from a Space Trajectory tape created by the Mission Planning and Analysis Division (MPAD) in the MPAD Common Format for the on-orbit phase of the Mission. Instructions for TRJPR1's use are given. Author

N81-24146*# Grumman Aerospace Corp., Bethpage, N.Y.
MANNED GEOSYNCHRONOUS MISSION REQUIREMENTS AND SYSTEMS ANALYSIS STUDY EXTENSION. VOLUME 1: EXECUTIVE SUMMARY Final Report
Feb. 1981 53 p
(Contract NAS9-15779)
(NASA-CR-160955) Avail: NTIS HC A04/MF A01 CSCL 22A

A study was performed to determine the types of manned missions that will likely be performed in the late 1980's or early 1990's timeframe, to define MOTV configurations which satisfy these missions requirements, and to develop a program plan for its development. Twenty generic missions were originally defined for MOTV but, to simplify the selection process, five of these missions were selected as typical and used as Design Reference Missions. Systems and subsystems requirements were re-examined and sensitivity analyses performed to determine optimum point designs. Turnaround modes were considered to determine the most effective combination of ground based and spaced based activities. A preferred concept for the crew capsule and for the mission mode was developed. T.M.

N81-24147# Committee on Science and Technology (U. S. House).
UNITED STATES CIVILIAN SPACE PROGRAMS, 1958 THRU 1978, VOLUME 1
Marcia S. Smith, George N. Chatham, Robert L. Civiak, Christopher

H. Dodge, David B. Hack, Barbara A. Luxenberg, Lani H. Raleigh, Wendy H. Schacht, and Charles S. Sheldon, II Washington GPO 1981 1398 p refs Presented to the Subcomm. on Space Sci. and Appl. of the Comm. on Sci. and Technol., 97th Congr., 1st Sess., Jan. 1981 Prepared by Congressional Research Service, Library of Congress
(GPO-50-366-Vol-1) Avail: SOD HC

A history of NASA and its relationship to U.S. space policy is presented. The facilities, tracking systems, launch vehicles, and propulsion methods are described. Special attention is given to manned space flight through 1975, the space transportation system, space life sciences, materials processing in space, space science programs, and international cooperation in space. The industrial and university support for NASA, and space program benefits were examined. T.M.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N81-24148*# Vought Corp., Dallas, Tex.
STUDY OF THERMAL CONTROL SYSTEMS FOR ORBITING POWER SYSTEMS. MATERIALS EXPERIMENT CARRIER THERMAL CONTROL SYSTEM STUDY
M. L. Fleming Nov. 1980 65 p refs
(Contract NAS8-33560)
(NASA-CR-161761; Rept-2-53020/1R-52637) Avail: NTIS HC A04/MF A01 CSCL 22B

Four possible arrangements of the materials experiment carrier (MEC) and power system (PS) thermal control loops were defined which would provide one kW of heat rejection for each kW of power to the MEC payload. These arrangements were compared to the baseline reference concept which provides only 16 kW heat rejection to show the cost of obtaining symmetry in terms of dollars, weight, complexity, growth potential, ease of integration, technology and total launch weight. The results of these comparisons was that the concept which splits the PS thermal control loop into two systems, one to reject PS waste heat and one payload waste heat, appeared favorable. The fluid selection study resulted in recommendation of FC72 as the MEC heat transport fluid based on the thermal and physical characteristics. The coatings reviewed indicated anodized and alodine treated aluminum surfaces or silver teflon are the best choices for the MEC vehicle where durability is an important factor. For high temperature radiators silver teflon or zinc orthotitanate are recommended choices. A.R.H.

N81-24149# Graz Univ. (Austria).
DATA COLLECTION PLATFORM IN THE ORBITAL TEST SATELLITE (OTS) GROUND STATION ALFLENZ/GRASSNITZ [DATENERFASSUNGSANLAGE IN DER OTS BODENSTATION AFLENZ/GRASSNITZ]
R. Lang, A. Horvath, A. Oberzalek, and F. Mair Oct. 1978 113 p In GERMAN
(INW-7804-A) Avail: NTIS HC A06/MF A01

Statistical data transmitted by Orbital Test Satellites were collected by the German ground station Aflenz/Grassnitz. Data values were calculated for meteorological occurrences (rain, wind direction, wind speed, air temperature) and for propagation. Measurements of the great number of data were processed by analog signals on the LM-Ericcson broadcasting and receiving apparatuses. The station was put into operation after extensive testing and its data are transmitted from Aflenz in Germany to Graz in Austria. Transl. by E.A.K.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N81-24150* National Aeronautics and Space Administration, Washington, D. C.
IMPROVED NOAA WEATHER SATELLITE SCHEDULED FOR NASA LAUNCH
27 Apr. 1981 8 p
(NASA-News-Release-81-55; P81-10055) Avail: NTIS HC A02/MF A01 CSCL 22A

A description of the GOES-E mission is presented and includes the instrumentation of the satellite, data acquisition, spacecraft description, and Delta Launch Vehicle description. The launch operations are presented and include major launch events, post-launch events, and a review of the Delta/GOES-E team. T.M.

N81-24151* National Aeronautics and Space Administration, Washington, D. C.
INTELSAT SATELLITE SCHEDULED FOR LAUNCH
15 May 1981 8 p
(NASA-News-Release-81-60; P81-10060) Avail: NTIS HC A02/MF A01 CSCL 22A

The launch schedule for Intelsat 5-B, the prime Intelsat satellite to provide communications services between the Americas, Europe, the Middle East, and Africa, is presented. The planned placement of the satellite into an elliptical transfer orbit, and circularization of the orbit at geosynchronous altitude over the equator are described. Characteristics of the Atlas Centaur launch vehicle, AC-56, are given. The launch operation is summarized and the launch sequence presented. The Intelsat team and contractors are listed. J.D.H.

N81-24152*# National Aeronautics and Space Administration, Washington, D. C.
MISSION OPERATION REPORT: OFFICE OF SPACE AND TERRESTRIAL APPLICATIONS
3 Jun. 1981 24 p
(E-615-81-03; NASA-TM-82355) Avail: NTIS HC A02/MF A01 CSCL 22A

The NOAA-C is the third NOAA-funded operational spacecraft of the TIROS-N series. A description of the mission is presented along with the NASA mission objectives for NOAA-C. Descriptions are also given of the spacecraft configuration and launch vehicle. The mission ground support systems were reviewed and the mission management responsibilities are summarized. T.M.

N81-24153# Georgia Inst. of Tech., Atlanta.
ELECTROMAGNETIC SIMULATION OF MISSILE EXHAUST PLUMES, CONSTRUCTION AND TESTING OF A PHYSICAL SIMULATOR AND THE PREDICTED RESULTS OF A THEORETICAL THIN WIRE ROCKET/PLUME MODEL
G. S. Smith, J. D. Norgard, W. A. Holm, and H. L. Bassett Mar. 1981 34 p refs
(Contract F30602-78-C-0120; AF Proj. 2064)
(AD-A098104; RADC-TR-81-8) Avail: NTIS HC A03/MF A01 CSCL 21/2

A full scale simulator of a typical low attitude missile plume was constructed. Carbon loaded foam was used in the model to simulate the electrical conductivity of the ionized exhaust gases expelled from the solid propellant motor. Theoretical computations made with the Low Altitude Plume Program (LAPP) were used to determine the distribution of conductivity in the simulator. A full size missile with the plume simulator attached was tested in an anechoic chamber. The missile was exposed to electromagnetic radiation and the voltage at an internal test

point in the circuitry was measured to determine the amount of energy that was coupled through the apertures in the missile. Azimuthal interference patterns were constructed by varying the angle of the incident radiation. The experimental patterns are in fair agreement with those computed from a simple theoretical electromagnetic analysis. Author (GRA)

N81-24154# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.

SPACECRAFT CHARGING RESULTS FROM THE SCATHA SATELLITE Interim Report

Harry C. Koons, Paul F. Mizera, Joseph F. Fennell, and David F. Hall 15 Mar. 1981 21 p refs

(Contract F04701-80-C-0081)

(AD-A097849; TR-0081(6505-02)-1; SD-TR-81-12) Avail: NTIS HC A02/MF A01 CSCL 22/2

Measurements made by surface potential monitors, contamination monitors, and electromagnetic interference monitors have successfully recorded the characteristics of satellite charging by the space environment. Differential potentials of several kilovolts have been measured between dielectric materials samples and space vehicle ground following the injection of energetic electrons around the vehicle. During some of these charging events, discharges have been detected. GRA

N81-24155# Naval Weapons Center, China Lake, Calif. Ordnance Systems Dept.

EVALUATION OF STATISTICAL FRACTURE CRITERIA FOR MAGNESIUM FLUORIDE SEEKER DOMES Technical Publication, 1978 - 1979

M. D. Herr and W. R. Compton Dec. 1980 57 p

(WF32300000)

(AD-A098109; AD-E900078; NWC-TP-6226) Avail: NTIS HC A04/MF A01 CSCL 16/4

Four statistical fracture theories are applied to the problem of infrared dome fracture in an aerodynamic heating environment. Theoretical fracture predictions are compared with time-to-fracture data obtained for full-scale magnesium fluoride domes in an aerodynamic heating environment. The surface-distributed flaw theory of Batdorf proves to yield the most accurate predictions of the probability of dome fracture. GRA

N81-24156# Hughes Aircraft Co., Culver City, Calif. Electro-Optical and Data Systems Div.

MANUFACTURING METHODS AND TECHNOLOGY ELECTROMAGNETIC COMPONENTS, VOLUME 1, PHASE 1 Final Report, Oct. 1978 - Oct. 1980

Earle R. Bunker, James R. Arnett, John L. Williams, King H. Li, and John L. Williams Dec. 1980 296 p refs

(Contract DAAK40-78-C-0271)

(AD-A098167; FR-80-76-1254R-Vol-1; HAC-REF-D8712-Vol-1) Avail: NTIS HC A13/MF A01 CSCL 09/5

Various techniques for the manufacture to low cost, high reliability core type transformers/inductors for missile system applications were investigated and evaluated. A typical missile C core high voltage inductor and toroidal core high voltage transformer were selected as representative test items. Molding technologies ranged from silicone or slush molds for low quantities, individually pressurizable hard models to liquid injection mold (LIM) with transfer presses. Over 40 encapsulation thermo setting compounds for high reliability components were tested and evaluated. Winding techniques included establishing parameters for damage of fine wire windings on square bobbins, and a method of continuously monitoring insulation integrity of magnet wire during winding operations for both toroid, and bobbin/stick winders. Use of spot bonding instead of mylar tape to hold windings in place during the winding operation was developed to eliminate voids caused by the tape during encapsulation/potting. Using a centrifuge for 5 to 10 minutes to remove bubbles from a poured transformer, then curing at room pressure showed promise over the conventional pressure cure at 500 psi for the required cure time and temperature. High voltage gradient estimation and control to achieve corona-free encapsulation was investigated. Various methods of establishing conductive surfaces for faraday shielding of molded bobbins were evaluated. Molds for casting void free bobbins were made. A method of discharge welding of C core bands under tension, without clips, to achieve a low profile, and eliminate solder creepage was demonstrated. GRA

N81-24157# Hughes Aircraft Co., Culver City, Calif. Electro-Optical and Data Systems Div.

MANUFACTURING METHODS AND TECHNOLOGY FOR ELECTROMAGNETIC COMPONENTS, VOLUME 2, PHASE 2 Final Report, Oct. 1978 - Oct. 1980

Earle R. Bunker, James R. Arnett, King H. Li, and John L. Williams Dec. 1980 222 p refs

(Contract DAAK40-78-C-0271)

(AD-A098168; FR-80-76-1254R-Vol-2; HAC-REF-D8712-Vol-2) Avail: NTIS HC A10/MF A01 CSCL 09/5

Over 40 encapsulation thermosetting compounds for high reliability components were tested and evaluated. Two compounds were selected, one for optimum for low stress applications, the other for high voltage, corona free applications. Winding techniques include establishing parameters for damage of fine wire windings on square bobbins, and a method of continuously monitoring insulation integrity of magnet wire during winding operations for both toroid, and bobbin/stick winders. T.M.

N81-24158# Teldix Luftfahrt-Ausruestungs G.m.b.H., Heidelberg (West Germany).

MAGNETIC BEARING MOMENTUM WHEEL FOR SATELLITE STABILIZATION Final Report

Rainer Sindlinger Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 34 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-W-79-38) Avail: NTIS HC A03/MF A01

A system was developed which actively stabilizes five degrees of freedom by means of electromagnets controlled by control loops. It was designed to be highly reliable, mechanically simple and of low mass. Its power consumption is low. Satellites can be stabilized and tilted through small angles about all three body axes; the nutation oscillations occurring in large satellite structures can be damped. This is done by magnetically tilting the spin vector. Functional and environmental tests are described and the results obtained are given in detail. Author (ESA)

N81-24159# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Hauptabteilung Raumfahrtprogramme.

COMMUNICATION SATELLITES FOR SOUTH AMERICA Final Report

Hans Loehle (Inst. fuer Telekommunikation, Munich), Hans-Martin Braun, and Michael Schmidbauer Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 144 p refs Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-W-79-41; ISSN-0170-1339) Avail: NTIS HC A07/MF A01

The impact of geographical, geophysical, economic and cultural factors on specific requirements was studied. Advanced communications systems are considered as important elements in achieving this aim. Brazil has embarked on a program to study television (educational and entertainment aspects) and telephony needs. Computer simulations were used to define an optimal South American satellite. The results indicate the technical and commercial feasibility of such a project. Author (ESA)

N81-24160# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Raumfahrtprogramme.

COMMUNICATIONS SATELLITE SYSTEM FOR AFRICA Final Report

Wolfgang Kriegl and Wilfried Laufenberg Bonn Bundesministerium fuer Forschung und Technologie Sep. 1980 76 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-W-80-016; ISSN-0170-1339) Avail: NTIS HC A05/MF A01

Earlier established requirement estimations were improved upon by contacting African administrations and organizations. An enormous demand is shown to exist for telephony and teletype services in rural areas. It is shown that educational television broadcasting should be realized in the current African transport and communications decade (1978-1987). Radio broadcasting is proposed in order to overcome illiteracy and to improve

educational levels. The technical and commercial feasibility of the system is provided by computer simulations which demonstrate how the required objectives can be fulfilled in conjunction with ground networks. Author (ESA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N81-24161*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PASSIVE OPTICAL SAMPLE ASSEMBLY (POSA) FOR STS-1 QUICK LOOK POST-MISSION REPORT
Roger C. Linton and Edgar R. Miller 1 Jun. 1981 17 p refs (NASA-TM-82421) Avail: NTIS HC A02/MF A01 CSCL 22A

A passively deployed array of contamination-sensitive samples was mounted and flown in the cargo bay of the space shuttle Columbia during the first orbital flight test. A similar unit was mounted in a different location in the cargo bay at Dryden Flight Research Center during the postflight operations there prior to the ferry flight return of Columbia to Kennedy Space Center. The samples in both POSA arrays were subjected to a series of optical and analytical measurements prior to delivery for installation in the cargo bay and after retrieval of the flight hardware. A quick-look summary of the results of a comparison of the series of measurements is presented. A.R.H.

N81-24162*# National Aeronautics and Space Administration, Washington, D. C.
SPACE SHUTTLE PROGRAM: STS-1 MEDICAL REPORT
26 May 1981 23 p
(NASA-TM-82333; S-989-81-01) Avail: NTIS HC A02/MF A01 CSCL 22A

The necessity for developing medical standards addressing individual classes of Shuttle crew positions is discussed. For the U.S. manned program the conclusion of the Apollo era heralded the end of water recovery operations and the introduction of land-based medical operations. This procedural change marked a significant departure from the accepted postflight medical recovery and evaluation techniques. All phases of the missions required careful re-evaluation, identification of potential impact on preexisting medical operational techniques, and development of new methodologies which were carefully evaluated and tested under simulated conditions. Significant coordination was required between the different teams involved in medical operations. Additional dimensions were added to the concepts of medical operations, by the introduction of different toxic substances utilized by the Space Transportation Systems especially during ground operations. S.F.

N81-24130*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SHUTTLE/SPACELAB DESIGN, PERFORMANCE, ACCOMMODATIONS AND CONSTRAINTS
In its Proc. of the Shuttle-Based Cometary Sci. Workshop 1976 p 7-91 (For primary document see N81-24128 15-12)
Avail: NTIS HC A12/MF A01 CSCL 22B

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N81-24163# New Mexico State Univ., Las Cruces. Physical Science Lab.
SUPPORT OF AFGL BALLOON TELEMETRY SYSTEM Final Report, 1 Jan. 1978 - 31 Jul. 1980
J. Craig Erickson and W. L. Craddock, Jr. 30 Sep. 1980 51 p
(Contract F19628-78-C-0080; AF Proj. 7659)
(AD-A097735; AFGL-TR-80-0372) Avail: NTIS HC A04/MF A01 CSCL 01/3

The Physical Science Laboratory (PSL) of the New Mexico State University (NMSU) provided support for the Air Force Geophysics Laboratory (AFGL) balloon telemetry systems. Support included updating and modifying existing land-based and mobile telemetry facilities located at Holloman AFB. Software was generated to utilize these facilities during computer supported balloon operations. Operational support was provided during these balloon tests for preflight, real time, and post flight test activities. GRA

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N81-24164*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SATELLITE RETRIEVAL SYSTEM Patent Application
Edwin C. Pruett (Essex Corp., Alexandria, Va.), Kem B. Robertson, III (Essex Corp., Alexandria, Va.), and Tomas E. Loughhead, inventors (to NASA) (Essex Corp., Alexandria, Va.) Filed 30 Mar. 1981 10 p Sponsored by NASA
(NASA-Case-MFS-25403-1; US-Patent-Appl-SN-248745) Avail: NTIS HC A02/MF A01 CSCL 22B

Two pairs of coacting parallel bars are separately mounted in spaced parallel planes on the front of a spacecraft. The bars of one pair are at right angles to bars of the other pair, and together the two pairs of bars effect a variable aperture adapted to close around a rod extending from a second spacecraft to thereby effect the capture of the latter. NASA

N81-24165*# Grumman Aerospace Corp., Bethpage, N.Y.
MANNED GEOSYNCHRONOUS MISSION REQUIREMENTS AND SYSTEM ANALYSIS STUDY EXTENSION. MANNED ORBITAL TRANSFER VEHICLE (MOTV) CAPABILITIES HANDBOOK AND USER GUIDE Final Report
Feb. 1981 163 p
(Contract NAS9-15779)
(NASA-CR-160956) Avail: NTIS HC A08/MF A01 CSCL 22B

The primary change in crew capsule definition is a smaller MOTV crew capsule, switching from a 3-man capsule to a 2-man capsule. A second change permitted crew accommodations for sleeping and privacy to be combined with the flight station. The current baseline DRM, ER1, requires 2 men for 3 to 4 days to repair a multi-disciplined GOE Platform and a modest amount of mission dedicated hardware. A 2-man MOTV crew capsule to be used as a design reference point for the OTV, and its interfaces between the STS and other associated equipment or facilities are described in detail. The functional capabilities of the 2-man capsule, as well as its application to a wide range of generic missions, is also presented. The MOTV turnaround is addressed and significant requirements for both space based and ground based scenarios are summarized. T.M.

N81-24166*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DISTRIBUTED CONTROL OF LARGE SPACE STRUCTURES
David B. Schaechter 1 May 1981 95 p refs Sponsored by NASA

(NASA-CR-164365; JPL-Pub-81-15) Avail: NTIS HC A05/MF A01 CSCL 22B

Theoretical developments and the results of laboratory experiments are treated as they apply to active attitude and vibration control, as well as static shape control. Modern control theory was employed throughout as the method for obtaining estimation and control laws. T.M.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N81-24167*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

LIFE TEST OF A NICKEL CADMIUM BATTERY WITH A PROTECTION/RECONDITIONING CIRCUIT

John R. Lanier, Jr. and John R. Bush, Jr. May 1981 19 p refs

(NASA-TP-1873; M-350) Avail: NTIS HC A02/MF A01 CSCL 10C

Results are discussed for a Ni-Cd battery test over a period of 8 years, 2 months and 44,213 simulated low Earth orbits. The battery cells were protected against overdischarge and reversal at discharge rates up to 25 amperes (1.25C) by a battery protection and reconditioning circuit. The circuit performed flawlessly during the test, and proved its value, both as a battery reconditioner and a cell protection device. Battery cell failures are also discussed. The test demonstrated the viability of using Ni-Cd batteries at depth-of-discharge up to 25 percent for over 5 years in a low Earth orbit. Author

N81-24168# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md. Chemical Propulsion Information Agency.

COMBUSTION INSTABILITY IN SOLID ROCKET MOTORS. VOLUME 2: A GUIDE FOR MOTOR DESIGNERS

Fred E. C. Culick (California Inst. of Technology, Pasadena) Jan. 1981 185 p refs

(Contract N00024-81-C-5301)
(CPIA-Pub-290-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 21H

The analytical models used to describe and predict combustion instability are discussed. The instrumentation and data reduction techniques to detect and analyze oscillations are described. The laboratory test methods used to measure pressure and velocity response functions are summarized. The control, suppression, and elimination of unsteady motions were evaluated as to their application to design procedures to reduce the risk of instability. T.M.

N81-24169# Los Alamos Scientific Lab., N. Mex.

IONOSPHERIC EFFECTS OF ROCKET EXHAUST PRODUCTS: SKYLAND AND HEAO-C

John Zinn, C. Dexter Sutherland, Lewis M. Duncan, and Sidney N. Stone 1981 8 p refs Presented at the Ionospheric Effects Symp., Alexandria, Va., 14 Apr. 1981

(Contract W-7405-eng-36)
(LA-UR-81-656; CONF-810421-1) Avail: NTIS HC A02/MF A01

Ionospheric F-layer depletions produced by chemical reactions with exhaust gases from large rockets are discussed. A 2-dimensional computer model of the ionosphere is described and model results are compared with experimental data on the structure and variability of the natural ionosphere, as well as data on ionospheric holes produced by the launches of Skylab and HEAO-C. Measurements made in conjunction with the HEAC-O launch are presented. The computer model includes an approximate representation of thermospheric tidal winds and E fields in addition to vertical motions associated with diurnal changes in temperature. The computed ionospheric structure is sensitive to all the above. For a small number of cases, results are compared of computations of the normal diurnal variations of ionospheric structure with incoherent scatter and total electron content data. Computations of ionospheric depletions from the Skylab and HEAO-C launches are in satisfactory agreement with the observations. The winds appear to be essential for interpretation of the Skylab results. DOE

N81-24170# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Technische Physik.

ANODE MECHANISM IN THE SELF INDUCED FIELD ACCELERATOR

Helmut Huegel 1980 149 p refs In GERMAN; ENGLISH summary

(DFVLR-FB-80-20) Avail: NTIS HC A07/MF A01

Operating mechanisms of the accelerator are described as well as phenomena which lead to changes in the discharge mode and a corresponding performance limitation. A theoretical magnetohydrodynamic model describing the flow field yields good agreement between calculated and measured data. Based on the results of this model in conjunction with anode fall theories, the boundary conditions are outlined under which the anode must perform its function at the various operating conditions. Calculations of anode fall voltages are in good agreement with experimentally obtained values. Author (ESA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N81-24171 Illinois Univ. at Urbana-Champaign.

COMPLEX PERIODIC AND CHAOTIC STATES IN HETEROGENEOUS CATALYTIC SYSTEMS Ph.D. Thesis

Anthony Philip Zioudas 1980 184 p

Avail: Univ. Microfilms Order No. 8108716

Simple theoretical models were developed accounting for usual kinetic and transport processes occurring in gas solid catalyzed reactions to explain experimentally observed complex, self generated, sustained dynamic behavior. The devised heterogeneous chemical oscillators were capable of exhibiting a range of dynamical behavior. This range included stable steady states, single peak and multi-peak periodic oscillations, and also chaotic behavior. The three ordinary differential equations models answered the puzzling question as to whether the experimentally observed complex dynamics is inherent in the equations of the proposed models rather than being caused by random influences or caused by processes of which no knowledge exist at the present. Dissert. Abstr.

N81-24172*# Massachusetts Inst. of Tech., Cambridge. Materials Processing Center.

THE MATERIALS PROCESSING RESEARCH BASE OF THE MATERIALS PROCESSING CENTER Annual Report

Merton C. Flemings, H. Kent Bowen, and George B. Kenney 1980 199 p

(Grant NsG-7645)
(NASA-CR-164367) Avail: NTIS HC A09/MF A01 CSCL 11G

The goals and activities of the center are discussed. The center activities encompass all engineering materials including

metals, ceramics, polymers, electronic materials, composites, superconductors, and thin films. Processes include crystallization, solidification, nucleation, and polymer synthesis. T.M.

N81-24173# Illinois Univ. at Urbana. Dept. of Chemistry.
CHEMILUMINESCENCE OF ORGANIC PEROXIDES. THERMAL GENERATION OF AN O-XYLYLENE PEROXIDE
Jimmie P. Smith, Alan K. Schrock, and Gary B. Schuster 7 Apr. 1981 44 p refs Submitted for publication
(Contract N00014-76-C-0745)
(AD-A098078; TR-31) Avail: NTIS HC A03/MF A01 CSCL 07/4

Thermolysis of 1,4-diphenyl-1,4-dioxa-2,3-benzopyrone (endoperoxide 1) in p-xylene solution generates chemiluminescence. Two intermediate products are formed from thermolysis of 1. The major product, trapped in 70% yield by added maleic anhydride, is 1,4-diphenyl-2,3-benzodioxin (o-xylylene peroxide 7). This peroxide becomes eventually o-dibenzoylbenzene 3 which is isolated from the reaction in 85% yield. The second intermediate is unidentified. It is formed in ca. 3% yield and apparently becomes eventually the other isolated product of the reaction phenyl-(o-benzoyl) benzoate (4). The chemiluminescence results from interaction of 7 with an added fluorescent activator or with the minor intermediate according to the chemically initiated electron-exchange luminescence (CIEEL) mechanism. Author (GRA)

N81-24174# Illinois Univ. at Urbana. Dept. of Chemistry.
CHEMILUMINESCENCE OF ORGANIC COMPOUNDS
Gary B. Schuster and Steven P. Schmidt 7 Apr. 1981 90 p refs
(Contract N00014-76-C-0745)
(AD-A098079; TR-30) Avail: NTIS HC A05/MF A01 CSCL 07/3

The mechanism of chemiluminescence of organic peroxides is reviewed. The topics covered are: General Requirements for Chemiluminescence; Generalized Mechanisms for Chemiluminescence of Organic Compounds in Solution; Chemiluminescence of Molecular Systems; Peroxyoxalate Chemiluminescence; Dioxetane Chemiluminescence; Diphenoyl Peroxide Chemiluminescence; Acyclic Secondary Peroxyester Chemiluminescence; Luminol Chemiluminescence; Miscellaneous Chemiluminescent Systems. Author (GRA)

N81-24175# Los Alamos Scientific Lab., N. Mex.
FIBER FELTS AS LOW DENSITY STRUCTURAL MATERIALS
John V. Milewski and Stephen E. Newfield 1981 10 p refs Presented at the SAMPE Symp./Exhibition, Los Angeles, 28-30 Apr. 1981
(Contract W-7405-eng-36)
(LA-UR-80-3423; CONF-810408-1) Avail: NTIS HC A02/MF A01

Short fiber felts structures can be made which provide improvements in properties over foams. In applications where resistance to compression set or stress relaxation are important, bonded fiber felts excel due to the flexing of individual fibers within their elastic limit. Felts of stainless steel and polyester fibers were prepared by deposition from liquid slurries. Compressive properties were determined as a function of felt parent material, extent of bonding, felt density, and length to diameter (L/D) ratio of starting fibers. DOE

24 COMPOSITE MATERIALS

Includes laminates.

N81-24176 Texas Univ. at Arlington.
THE CHARACTERIZATION OF THE INTERFACE IN GRAPHITE-ALUMINUM COMPOSITE SYSTEMS Ph.D. Thesis
Swe-Den Tsai 1980 41 p
Avail: Univ. Microfilms Order No. 8109255

The experimental approaches used included the following: (1) scanning Auger electron microscopy; (2) transmission electron microscopy; (3) residual stress measurement with X-ray diffraction technique; and (4) electronic characteristics. The interface between the aluminum matrix and the graphite fiber was found to be very complex. Titanium diboride, TiB2 and aluminum oxide gamma Al2O3 and complexes of these phases were present as the interfacial phases. The grain size, crystallographic structure and surface chemistry of the phases were studied in detail. Large tensile residual stresses existed in the aluminum matrix along the fiber direction and lower tensile residual stresses were present in the aluminum matrix in the direction transverse to the fiber. A memory switching phenomenon was observed in I-V curves used to electronically characterize the interface structure. Dissert. Abstr.

N81-24177 Delaware Univ., Newark.
ON THE THERMOELASTIC RESPONSE OF COMPOSITE MATERIALS Ph.D. Thesis
Acintya Kumar Mukhopadhyay 1981 273 p
Avail: Univ. Microfilms Order No. 8109625

Improved variational principles were applied to the development of improved bounds on the thermoelastic properties of a wide class of composite materials: polymeric resins reinforced with continuous fibers, short (discontinuous) fibers, and particles in recognition of the limited amount and restricted forms of accessible information, the theory was cast in a form to accommodate quantitative parameters to describe dominant structural features; the volume fraction concentration of the components; statistical characteristics of the orientation distribution of the fibers; and the characteristic features of the reinforcing geometry (e.g., the aspect ratio). Within the confines of this limited information, the resulting bounding theory provides the best possible bounds on the thermoelastic properties; the Young's moduli, the shear moduli, the Poisson's ratios, the coefficients of thermal expansion, and the heat capacity. Dissert. Abstr.

N81-24178*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STRESS-CONCENTRATION FACTORS FOR FINITE ORTHOTROPIC LAMINATES WITH A PIN-LOADED HOLE
John H. Crews, Jr., C. S. Hong (Korea Inst. of Science, Seoul), and I. S. Raju (George Washington Univ., Hampton, Va.) May 1981 43 p refs
(NASA-TP-1862) Avail: NTIS HC A03/MF A01 CSCL 11D

Stresses were calculated for finite size orthotropic laminates loaded by a frictionless steel pin in a circular hole of the same diameter. The calculations were based on finite element analyses for six laminates. Stress concentration factors, based on nominal bearing stress, were determined for wide ranges of the ratios of width to diameter, w/d and edge distance to diameter, e/d. An infinite laminate case was analyzed for each laminate. Orthotropy had a significant influence on the tensile stress concentration at the hole. For example, the stress concentration factors for the infinite laminate cases ranged from 0.82 to 2.16, compared with 0.87 for the quasi-isotropic laminate. The finite widths and edge distances strongly influenced the tensile stress concentration. For the practical range $w/d > \text{or} = 3$, the peak tensile stresses were as much as 80% larger than the infinite laminate reference value. For $e/d > \text{or} = 3$, these stresses were amplified by as much as 50%. In contrast, the finite width and edge distance had little effect on shear-out and bearing stress concentrations. E.D.K.

N81-24179*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFECTS OF STATIC TENSILE LOAD ON THE THERMAL EXPANSION OF Gr/PI COMPOSITE MATERIAL
Gary L. Farley Jun. 1981 35 p refs Prepared in cooperation with Army Aviation Research and Development Command, Hampton, Va.
(DA Proj. 1L1-61102-AH-45)
(NASA-TP-1867; AVRADCOM-TR-81-B-2; L-14012) Avail: NTIS HC A03/MF A01 CSCL 11D

The effect of static tensile load on the thermal expansion of Gr/PI composite material was measured for seven different laminate configurations. A computer program was developed which implements laminate theory in a piecewise linear fashion to predict the coupled nonlinear thermomechanical behavior. Static tensile load significantly affected the thermal expansion characteristics of the laminates tested. This effect is attributed

to a fiber instability micromechanical behavior of the constituent materials. Analytical results correlated reasonably well with free thermal expansion tests (no load applied to the specimen). However, correlation was poor for tests with an applied load.
Author

N81-24180*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.
DEVELOPMENT OF ADVANCED LIGHTWEIGHT CONTAINMENT SYSTEMS Final Report
C.L. Stotler May 1981 86 p refs
(Contract NAS3-21823)
(NASA-CR-165212; R81AEG208) Avail: NTIS HC A05/MF A01 CSCL 11D

Parametric type data were obtained on advanced lightweight containment systems. These data were used to generate design methods and procedures necessary for the successful development of such systems. The methods were then demonstrated through the design of a lightweight containment system for a CF6 size engine. The containment concept evaluated consisted basically of a lightweight structural sandwich shell wrapped with dry Kevlar cloth. The initial testing was directed towards the determination of the amount of Kevlar required to result in threshold containment for a specific set of test conditions. A relationship was then developed between the thickness required and the energy of the released blade so that the data could be used to design for conditions other than those tested. E.D.K.

N81-24181*# United Technologies Corp., East Hartford, Conn.
RESEARCH ON GRAPHITE REINFORCED GLASS MATRIX COMPOSITES Final Report, Mar. 1976 - Feb. 1981
K. M. Prewo and E. R. Thompson May 1981 149 p refs
(Contract NAS1-14346)
(NASA-CR-165711; R81-912545-61) Avail: NTIS HC A07/MF A01 CSCL 11D

A broad group of fibers and matrices were combined to create a wide range of composite properties. Primary material fabrication procedures were developed which readily permit the fabrication of flat plate and shaped composites. Composite mechanical properties were measured under a wide range of test conditions. Tensile, flexure mechanical fatigue, thermal fatigue, fracture toughness, and fatigue crack growth resistance were evaluated. Selected fiber-matrix combinations were shown to maintain their strength at up to 1300 K when tested in an inert atmosphere. Composite high temperature mechanical properties were shown to be limited primarily by the oxidation resistance of the graphite fibers. Composite thermal dimensional stability was measured and found to be excellent. E.D.K.

N81-24182*# Douglas Aircraft Co., Inc., Long Beach, Calif.
INVESTIGATION OF THE EFFECT OF RESIN MATERIAL ON IMPACT DAMAGE TO GRAPHITE/EPOXY COMPOSITES Final Report
R. J. Palmer May 1981 120 p refs
(Contract NAS1-12675)
(NASA-CR-165677) Avail: NTIS HC A06/MF A01 CSCL 11D

The results of an experimental program are described which establishes the feasibility and guide lines for resin development. The objective was to identify the basic epoxy neat resin properties that improve low velocity impact resistance and toughness to graphite-epoxy laminates and at the same time maintain useful structural laminate mechanical properties. Materials tests from twenty-three toughened epoxy resin matrix systems are included. E.D.K.

N81-24183# Naval Research Lab., Washington, D. C.
CATALYZED COMBUSTION OF CARBON FIBERS FROM CARBON FIBER-RESIN COMPOSITES Final Report, Oct. 1977 - Oct. 1980
J. Ganjei, D. Dominguez, J. Mackey, and J. Murday 22 Apr. 1981 76 p refs
(WF61542001)
(AD-A098046; NRL-MR-4486) Avail: NTIS HC A05/MF A01 CSCL 11/5

A Government-wide program was developed in response to the potential electrical hazards associated with carbon fiber release from carbon fiber composites used as structural materials for military aircraft. Fibers can be released during/after accidental burn or burn/blast scenarios where the composite epoxy ignites and is burnt off, leaving the base carbon fiber structure behind. Under these conditions, the major process for fiber gasification is the reaction of carbon and oxygen to form carbon monoxide and carbon dioxide. The rate of fiber oxidation can be enhanced considerably by the addition of metal catalysts to the fiber surface when the rate is not controlled by reactant oxygen diffusion. The work performed by the Chemistry Division of the Naval Research Laboratory involved the implementation and evaluation of metal additives to the composite epoxy resin for enhancing the gasification of carbon fibers, thereby reducing the amount of fibers left for release. Author (GRA)

N81-24184# Naval Surface Weapons Center, Dahlgren, Va. Combat System Dept.
THERMOGRAVIMETRIC DETERMINATION OF KINETIC PARAMETERS FOR THE THERMAL DEGRADATION OF SEVERAL ABLATIVE MATERIALS Final Report
M. R. Tant, J. B. Henderson, and G. R. Moore Dec. 1980 39 p refs
(ZR0000101)
(AD-A097890; NSWC/TR-80-290) Avail: NTIS HC A03/MF A01 CSCL 11/4

The thermal decomposition of several composite ablative materials being considered for shipboard use was studied using thermogravimetry. Thermograms were obtained at six heating rates ranging from 10 to 160 C/min. From these data, the kinetic parameters were determined by a modified version of Friedman's method. Activation energies determined by this method were compared with those obtained by the method of Flynn and Wall. Author (GRA)

N81-24185# Lockheed-California Co., Burbank.
EXPERIMENTAL INVESTIGATION OF THE INTERACTION OF MOISTURE, LOW TEMPERATURE, AND LOW LEVEL IMPACT ON GRAPHITE/EPOXY COMPOSITES Final Report
K. N. Lauraitis and P. E. Sandorff Oct. 1980 78 p refs
(Contract N62269-79-C-0276)
(AD-A097706; LR-29655; NADC-79102-60) Avail: NTIS HC A05/MF A01 CSCL 11/4

Effect of low speed impact damage on composite materials is a new and potentially significant design condition for high performance systems. In metallic structure, damage due to tool drop, small rock impact and hail (while on the ground) did not constitute a damage of major concern. However, composites generally exhibit little inelastic ductility, are sensitive to secondary stresses, and are susceptible to splitting and delamination with cracks often propagating in the fiber direction through debonding. Upon failure, energy absorption is low. Due to these fracture characteristics and the low strain to failure, composite materials generally exhibit lower impact resistance than the metals typically used for aircraft construction. Environmental exposure may aggravate the deleterious effects of impact damage. It is well known that the mechanical properties of a polymeric matrix are susceptible to environmental degradation. Matrix cracking resulting from impact, loading or thermal cycling may provide pathways for moisture which can enter by laminar flow much more rapidly than by diffusion upon subsequent exposure to high humidity environment. Detrimental effects may also be expected because the internal tensile stress in the matrix increases with decreasing temperature, promoting crazing and the formation of microvoids.
GRA

N81-24186# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Mechanics and Surface Interactions Branch.
PROCEEDINGS OF THE ANNUAL MECHANICS OF COMPOSITES REVIEW (6TH)
Marvin Knight Feb. 1981 111 p refs Conf. Held at Wright-Patterson AFB, Ohio, 28-30 Oct. 1980
(AF Proj. 2419)
(AD-A098295; AFWAL-TR-81-4001) Avail: NTIS HC A06/MF A01 CSCL 11/4

This report contains summaries of the presentations at the Sixth Annual Mechanics of Composites Review sponsored by the Air Force Materials Laboratory. Each paper was prepared by

its presenter and is published here unedited. In addition to the presenter's summaries, a listing of both the inhouse and contractual activities of each participating organization is included. Author (GRA)

N81-24187# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Structures Lab.
POROUS PORTLAND CEMENT CONCRETE: THE STATE OF THE ART Final Report, Jan. - Jul. 1980
Alfred Monahan Jan. 1981 34 p refs
(Contract DOT-FA79WAI-131)
(AD-A098177; FAA-RD-80-110) Avail: NTIS HC A03/MF A01 CSCL 11/2

This study investigates the current state of the art relating to the production and use of those porous portland cement concretes that may be suitable for the construction of porous portland cement friction courses. Porous concretes produced by gap grading or elimination of the fine aggregate fraction were found to have been used in both pavement and nonpavement applications with varied degrees of success. Nonpavement applications discussed include: porous draintiles and drains, porous concrete floors in greenhouses, and a porous concrete blanket placed on an earthfill dam. Pavement applications discussed include: a no-fines pavement layer, porous portland cement concrete pavements, and porous pavement edge drains or porous hard shoulders. Evidence as to the suitability of porous portland cement concretes for the construction of porous portland cement friction courses is inconclusive. The successful use of porous concretes in other pavement applications does, however, suggest that porous concretes may be useful in the construction of friction courses. Author (GRA)

N81-24188# Wyoming Univ.; Laramie. Composite Materials Research Group.
FINITE ELEMENT MICROCHEMICAL ANALYSIS OF A UNIDIRECTIONAL COMPOSITE INCLUDING LONGITUDINAL SHEAR LOADING Final Report, Sep. 1979 - Dec. 1980
David A. Crane and Donald F. Adams Watertown, Mass. Army Materials and Mechanics Research Center Feb. 1981 132 p refs
(Contract DAAG46-79-C-0076)
(AD-A097811; UWME-DR-101-101-1; AMMRC-TR-81-7) Avail: NTIS HC A07/MF A01 CSCL 11/4

A microscopic region of a unidirectional composite is modeled by a finite element micromechanical analysis using a generalized plane strain formulation, but including longitudinal shear loading. The analysis is capable of treating elastic, transversely isotropic fiber materials, as well as isotropic, elastoplastic matrix materials. Matrix material properties are considered to be temperature- and/or moisture-dependent. A special Gaussian elimination procedure is modified for the present treatment. Stresses are calculated for each element and appropriate failure criteria invoked. First-element failure is the limit of the present analysis. Other possible forms of results are: unidirectional composite properties; overall composite stress-strain response; and various plots of internal stress contours. The longitudinal shear loading capability permits the analysis of shear response of unidirectional composites in the fiber direction. Solid rod torsion test data used to obtain experimental verification indicate good agreement with the theoretical predictions for glass/epoxy and graphite/epoxy at various temperature and moisture conditions. In conjunction with a laminated plate point stress analysis, the present micromechanical analysis has been used to predict the stress-strain response into the inelastic range of a graphite/epoxy (+ or - 45) 4s laminate. Available experimental data for various environmental conditions indicate excellent agreement with the analytical predictions. GRA

N81-24189# Messerschmidt-Boelkow G.m.b.H., Munich (West Germany).
METALLOGRAPHIC AND FRACTOGRAPHIC RESEARCH IN FIBER REINFORCED POLYCARBONATES [METALLOGRAPHISCHE UND FRAKTOGRAPHISCHE UNTERSUCHUNGEN AN FASERVERSTAERKTEN VERBUNDWERKSTOFFEN]
H. Leis, H. E. Franz, and A. Ettingshausen Ottobrun, West Germany 1979 25 p refs In GERMAN
(MBB-BB-444/79-O) Avail: NTIS HC A02/MF A01

The compilation of a fracture atlas of scanning electron micrographs of fiber reinforced polycarbonates for studying plane strain fractures is described. Causes of the fractures are discussed and an analysis of the fracture characteristics is provided. The significance of metallography and fractography is not limited to the development of fiber reinforced polycarbonates, but also covers product safety and the damage analysis of fiber reinforced structural parts. In some cases the lifetime of the materials can be predicted. Author (ESA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N81-24190 Colorado State Univ., Fort Collins.
NOVEL PHOTOELECTROCHEMICAL SYSTEMS INCORPORATING MOLTEN SALT ELECTROLYTES Ph.D. Thesis
Paramjit Singh 1980 227 p
Avail: Univ. Microfilms Order No. 8110835

Photoelectrochemical (PEC) characterization of n-GaAs and n-Si electrodes were carried out in the aluminum chloride-butyl pyridinium chloride (A1C13-PBC) room temperature molten salt electrolyte. The use of molten salt electrolytes in PEC cells was demonstrated by the n-GaAs /1:1 A1C3-BPC, ferrocene/ferricenium chloride /C system. Cyclic voltammetry and flatband potential measurements on n-GaAs and n-Si in the melt enabled location of the melt stability windows and the semiconductor band edges. Photogenerated holes on n-GaAs electrodes were competitively captured by ferrocene at the expense of the parasitic electrode dissolution reaction as evidenced by the constancy of the short circuit current. The underpotentials observed for the photoanodic process on n-GaAs relative to vitreous carbon were direct evidence for conversion of light to electrical energy.
Dissert. Abstr.

N81-24191 Illinois Univ. at Urbana-Champaign.
DYNAMICS OF CARBON-MONOXIDE ON PLATINUM Ph.D. Thesis
Sean Xianming Zhang 1980 95 p
Avail: Univ. Microfilms Order No. 8108714

A study of kinetics of CO oxidation on a platinum ribbon in a gradientless reactor is presented. An isothermal condition was maintained on the catalyst surface. The reaction rate was measured by a calorimetric technique, and measurements of the effluent CO2 concentration were made with an infrared analyzer. The experimental system proved to be capable of yielding reproducible data and of exploring phenomena and reaction behavior in general. The kinetic model describing the reaction system predicted only simple hysteresis. The behavior of complex hysteresis was thought to be a result of the moderate mass transfer resistance coupled with the heterogenous reaction. That complex hysteresis disappeared at high flow rates illustrated that multiplicity also arises from the mass feedback mechanism inherent with backmixing in the continuously stirred tank reactor. Dissert. Abstr.

N81-24192 Illinois Univ. at Urbana-Champaign.
GOLD SURFACES FOR DROPWISE CONDENSATION Ph.D. Thesis
David Winfield Woodruff 1980 301 p
Avail: Univ. Microfilms Order No. 8108707

Gold surfaces were investigated as promoters of dropwise condensation of steam at atmospheric pressure. Seven gold electroplating baths, one electroless immersion gold plating bath, and vacuum gold vapor deposition were used as deposition techniques. Five different surface preparation techniques of a pure gold sample were tested. Gold deposits ranged in thickness from 100 A to 20,000 A with major emphasis from 200 A to 5000 A. Auger electron spectroscopy and scanning electron

microscopy were used to describe the heat transfer surfaces chemically and physically. Dissert. Abstr.

N81-24193 Illinois Univ. at Urbana-Champaign.
MICROCOMPUTER-CONTROLLED TITRIMETRIC AND SPECTROPHOTOMETRIC SYSTEMS AND ANALYTICAL APPLICATIONS Ph.D. Thesis
Alan Hsueh-Bing Wu 1980 398 p
Avail: Univ. Microfilms Order No. 8108708

A versatile microcomputer controlled titrator was developed that is capable of handling UV-vis spectrophotometric, potentiometric and amperometric end-point detection, and acid-base, redox, compleximetric, and precipitation reactions in aqueous and nonaqueous titration media. Titrants can be delivered either by burets operated in a continuous constant rate mode, or incremental modes, and by coulometric generation. Auxiliary pipets and burets are interfaced for dilution, buffering and adjustments of pH or ionic strength. The instrument is made from standard laboratory modules including titrator stand, spectrophotometer, potentiostat, constant-current source, and pH meter. Dissert. Abstr.

N81-24194 Illinois Univ. at Urbana-Champaign.
FABRY-PEROT CAVITY, PULSED FOURIER TRANSFORM MOLECULAR BEAM MICROWAVE SPECTROSCOPY Ph.D. Thesis
Terrill Joseph Balle 1980 102 p
Avail: Univ. Microfilms Order No. 8108446

After a short introduction to cavity spectrometers, the foundations of the theory of a Fabry-Perot cavity, of molecular polarization, and of molecular beams is presented as it relates to this spectrometer. The block diagram is presented that shows how these techniques are incorporated into a working system. Certain design considerations relevant to the construction of this spectrometer are discussed. The results of observations on weakly bound molecular complexes are briefly considered, with references to the journal publications for complete explanations. The potential of this method to this and other scientific pursuits is considered. A summary of advantages and disadvantages is discussed in conclusion. Dissert. Abstr.

N81-24195 Arizona Univ., Tucson.
DIGITAL SIGNAL PROCESSING TECHNIQUES APPLIED TO CHROMATOGRAPHY Ph.D. Thesis
Carl Daniel Villalanti 1980 153 p
Avail: Univ. Microfilms Order No. 8109047

The effects of restricting the concentration range a solute undergoes was the impetus for a type of multiple injection experiment, known as frequency modulated (FM) correlation chromatography. By limiting the deviation in concentration to a small portion of the isotherm, Gaussian shaped peaks can be obtained even when working in a nonlinear portion of is isotherm. The characterization of the experimental parameters in FM experiments and the effects on peak shape, retention time, and signal to noise ratios was evaluated. The FM multiple injection technique was applied to the study of linear and nonlinear behavior on a homogenous and heterogeneous chromatographic support. Specific types and strengths of solute-adsorbent interacts are proposed. Dissert. Abstr.

N81-24196 Stanford Univ., Calif.
MECHANISTIC STUDIES OF GAS-PHASE PROTON-TRANSFER REACTIONS, 1. INFRARED MULTIPHOTON-INDUCED PHOTOCHEMISTRY OF GAS-PHASE IONS, 2 Ph.D. Thesis
Joseph Martin Jasinski 1981 266 p
Avail: Univ. Microfilms Order No. 8108953

Theoretical and experimental approaches to understanding the dynamics of gas-phase proton transfer are described. A theoretical model is discussed which employs Rice-Ramsperger-Kassel-Marcus theory to calculate rate constants for three-body ion-molecule association reactions. Experimental kinetic studies of proton and deuteron transfer between pyridine bases in the gas phase are described. In these studies, pulsed ion cyclotron resonance spectroscopy is used to measure rate constants for proton transfer and to measure primary kinetic deuterium isotope effects as a function of alkyl substitution at the alpha positions of the pyridines. The development of a technique which permits infrared multiphoton dissociation of gas-phase ions to be studied under collisionless conditions. Results are presented which suggest that infrared multiphoton dissociation of proposed intermediates in ion molecule reactions may provide information on the dynamics of thermal ion molecule reactions. Dissert. Abstr.

N81-24197 Nebraska Univ., Lincoln.
APPLICATIONS OF MASS SPECTROMETRY IN BIOLOGICAL, ENVIRONMENTAL AND GAS-PHASE ORGANIC ION CHEMISTRY Ph.D. Thesis
David Richard Hilker 1981 167 p
Avail: Univ. Microfilms Order No. 8110572

The application of high performance mass spectrometry for the structural determination of a complex biological molecule, the ornithine containing lipid from Thiobacillus Thiooxidans, is discussed. Fragmentation generated pathways occur in the electron impact decomposition of the ornithine lipid. The sepctrum arises in three primary decompositions which separate the two fatty acid constituents. Thermolysis occurs in at least two steps. Dehydration of the ornithine produces a substituted piperidone, and this fragment undergoes a facile elimination to produce a long chain fatty acid and piperidone containing fatty amide. A high resolution mass spectrometer/signal averager system was employed to analyze 2,3,7,8-tetrachlorodibenzo-p-dioxin at the parts per trillion level. The energy partitioning quotient for loss of water from the molecular ion of o-methylbenzyl alchohol and various derivatives was studied. It is concluded that the large kinetic energy release loss of water from the alcohol, indicates a large fraction of energy partitioned into the translational mode for this compound than for the other members of the series. Dissert. Abstr.

N81-24198 Ohio Univ., Athens.
APPLICATIONS OF DIFFUSE REFLECTANCE INFRARED FOURIER TRANSFORM SPECTROMETRY Ph.D. Thesis
Michael Paul Fuller 1980 144 p
Avail: Univ. Microfilms Order No. 8110493

Several diffuse reflectance optical systems compatible with a commercial Fourier transform infrared (FT-IR) spectrometer were constructed and the relative efficiencies are discussed. Direct comparisons with conventional transmittance FT-IR measurements were made as a method of evaluating this technique in terms of sensitivity and spectral quality. Work involving some of the fundamental factors affecting diffuse reflectance spectra such as particle size distributions, sample depths, and concentration are discussed. Analytical applications in the areas of pharmaceutical quality control, forensic analysis, coals and coal products analysis, and microsampling are presented. Dissert. Abstr.

N81-24199 Toledo Univ., Ohio.
ANALYSIS OF PRESSURE SPECTRA MEASUREMENTS IN A DUCTED COMBUSTION SYSTEM Ph.D. Thesis
Jeffrey Hilton Miles 1980 140 p
Avail: Univ. Microfilms Order No. 8110597

The presence of combustor emissions in the duct is proposed as the primary mechanism producing the attenuation and dispersion of combustion noise propagating in an operating liquid fuel combustion system. A complex mathematical model for calculating attenuation and dispersion taking into account mass transfer, heat transfer, and viscosity effects due to the presence of liquid fuel droplets or solid soot particles is discussed. A simpler single parameter model for calculating pressure auto-spectra and cross-spectra which takes into account dispersion and attenuation due to heat transfer between solid soot particles and air is developed. Autospectra and cross-spectra obtained from internal pressure measurements in a combustion system consisting of a J-47 combustor can, a spool piece, and a long duct are presented. The analytical results obtained with the single parameter model are compared with the experimental measurements. The single parameter model results are shown to be in excellent agreement with the measurements. Dissert. Abstr.

N81-24200# Council for Scientific and Industrial Research, Pretoria (South Africa).
REVIEW OF EXPERIMENTAL METHODS FOR DETERMINING EFFECTIVE DIFFUSIVITIES IN CATALYST PELLETS
D. S. vanVuuren Mar. 1980 30 p refs
(CSIR-CENG-319) Avail: NTIS HC A03/MF A01

Various techniques used to determine liquid diffusivity data

on nitrogen compounds in catalyst pores, with specific application to liquid phase catalytic hydrodenitrogenation of coal liquids, are examined. A suitable technique should yield repeatable results, be quick, have small solvent requirement, and the required apparatus must be able to withstand moderately elevated temperatures. Factors discussed include time dependency, single or multiple pellet, geometry or configuration, mathematical parameter estimation method, input function, and model. Only nonreacting systems are considered in order to study the influence of parameters, such as the particle porosity and pore size, on the diffusivity over a wide range. It is recommended that the steady state Wicke-Kallenbach method be used for the determination of gas phase diffusivity and transient methods be used for the liquid phase. J.M.S.

N81-24201# Stanford Univ., Calif. Dept. of Chemistry.
THEORY AND EXPERIMENTS ON CHEMICAL INSTABILITIES Final Report, Dec. 1976 - Dec. 1980
John Ross Jan. 1981 38 p
(Grant AF-AFOSR-0094-80; AF Proj. 2303)
(AD-A098066; AFOSR-81-0348TR) Avail: NTIS HC A03/MF A01 CSCL 07/4

The Franck-Condon approximation of treating an electronic transition in a molecular system at fixed nuclear coordinates is shown to provide qualitatively correct predictions. The theory was applied to adiabatic and nonadiabatic collisions. So far only relative rates have been calculated and the chailenge of predicting absolute rates remains open. A stochastic theory of nucleation in phase transitions has been developed in which the equivalence of a thermodynamic and kinetic formulation of critical cluster sizes is shown. Suitable use of a combination of a master equation and a form of transition probability according to Langer has been shown to lead to a most probable evolution in time which is in fact the deterministic rate equation. An extensive investigation of the formal theory of statistical mechanics of stationary states has begun. GRA

N81-24202# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
FUELS COMBUSTION RESEARCH Annual Report, 1 Oct. 1979 - 30 Sep. 1980
Irvin Glassman and Frederick L. Dryer 27 Feb. 1981 35 p refs
(Contract F49620-78-C-0004; AF Proj. 2307)
(AD-A098103; MAE-1513; AFOSR-81-0397TR) Avail: NTIS HC A03/MF A01 CSCL 21/2

A high temperature sampling system for the Princeton flow reactor has been developed. Initial results have been obtained on the oxidation of toluene Benzaldehyde forms as an important intermediate and then the process becomes one of the oxidizing formyl and phenyl reactions. The effects of oxygen index and temperature on sooting diffusion flames have been studied. Results indicate that the stoichiometric flame temperature dominates the sooting tendency and that the C4 and C5 olefine and diolefins and the aromatics are the most dominant sooting fuels. In development as well are a powerful family of sensitivity analysis tools to quantitatively address the complex interaction between a combustion system's chemical and transport component. GRA

N81-24203# Life Systems, Inc., Cleveland, Ohio. Environmental Protection Research Div.
EVALUATION OF BREADBOARD ELECTROCHEMICAL TOC/COD ANALYZER: ADVANCED TECHNOLOGY DEVELOPMENT Annual Report, 31 Oct. 1978 - 15 Aug. 1980
J. B. Lantz, R. J. Davenport, and R. A. Wynveen Aug. 1980 70 p refs
(Contract DAMD17-76-C-6077)
(AD-A097831; LSI-TR-310-4-3) Avail: NTIS HC A04/MF A01 CSCL 07/3

The Advanced Breadboard TOC/COD Analyzer was designed, fabricated, assembled and the testing program for its evaluation was initiated. The Analyzer was designed for simple, automated operation. It incorporates many advanced features that are designed to either provide more data than is available using other analyzers, or to more effectively integrate the Analyzer into process monitoring/control applications and applications involving water quality monitoring in remote areas. Further activities will include completion of the testing program. Also, a method of preventing interferences in the organic solute measurements due to chloride in the water samples will be developed and integrated into the Advanced Breadboard. Author (GRA)

N81-24204# Atlantic Research Corp., Alexandria, Va.
PREDICTED AND MEASURED EFFECTS OF PRESSURE AND CROSSFLOW VELOCITY ON COMPOSITE PROPELLANT BURNING RATE
Merrill K. King Dec. 1980 27 p refs
(Contract F49620-78-C-0016; AF Proj. 2308)
(AD-A098090; AFOSR-81-0393TR) Avail: NTIS HC A03/MF A01 CSCL 21/9

A theoretical model for prediction of burning rates of composite (ammonium perchlorate oxidizer) solid propellants as a function of pressure and crossflow velocity has been developed. Included in this model is the capability for treatment of multimodal oxidizer particle sizes and metalized formulations. In addition, an experimental device for measuring the effects of crossflow velocity on propellant burning rate has been developed and used to characterize a series of AP/HTPB propellants with systematically varied formulation parameters. Model predictions of zero-crossflow burning rate versus pressure characteristics have been found to be in excellent agreement with data, while the agreement between erosive burning predictions and data is in general good. GRA

N81-24205# Kansas State Univ., Manhattan. Dept. of Chemistry.
DEVELOPMENT AND USE OF TIME RESOLVED SPECTROSCOPY Final Report, 1 Jun. 1978 - 28 Feb. 1981
W. G. Fateley and R. M. Hammaker Mar. 1981 116 p refs
(Grant AF-AFOSR-3617-78; AF Proj. 2303)
(AD-A098081; AFOSR-81-0351TR) Avail: NTIS HC A06/MF A01 CSCL 07/4

The research reported demonstrates the application of Time Resolved Spectroscopy (TRS) to dynamic conditions in polymers. The Michelson's interferometer and Fourier Transform Spectroscopy (FTS) were employed in this study. TRS technique involves the coordination of reaction stimulation, e.g., pulsed laser excitation of gases or stretching and relaxation in polymers, and the recording of the interferogram at some unit time after stimulation. In the cases of gases, for versatility the reaction vessel is designed to allow either emission or absorption studies. Time resolved spectroscopy provides a very attractive means for the elucidation of the structure of reaction intermediates and products, because this technique provides sufficient data for examination of the band shapes of materials and deduction of the energy distributions within the molecules for successive times during reaction. Author (GRA)

N81-24206# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
INFRARED ANALYSIS OF GASOLINE/ALCOHOL BLENDS Interim Report
Frank M. Newman and Susan M. Biela Feb. 1981 30 p
(Contract DAAK70-80-C-0001)
(AD-A098258; AFLRL-134) Avail: NTIS HC A03/MF A01 CSCL 21/4

An infrared method for qualitative and quantitative determination of alcohols in gasoline/alcohol blends has been developed. The method has high potential for speed, low cost, and specificity. Gasoline containing methanol, ethanol, iso-propanol, t-butanol, methyl t-butyl ether, and methyl iso-butyl ketone (MIBK) can be analyzed using a computing infrared spectrophotometer. Due to variable composition of different gasolines, each base gasoline analyzed required a new quantitative program to be established, using standards prepared with that particular gasoline. Author (GRA)

N81-24207# Illinois Univ., Urbana.
STRUCTURAL RELATIONSHIP IN CHLOROPLAST MEMBRANES Final Report, 1 Aug. 1977 - 31 Aug. 1980
Sep. 1980 7 p refs
(Contract DE-AS02-77ER-04475)
(DOE/ER-04475/2) Avail: NTIS HC A02/MF A01

Methodology was developed for the isolation and characterization of pigment proteins from chloroplast membranes. Characterization of these pigment proteins increased understanding of mechanisms regulating the efficiency of photosynthetic light harvesting during photosynthesis. Incorporation of isolated pigment protein complexes into model membranes allowed simulation of grana stacks; these structural features of chloroplasts play a key role in maintaining appropriate interactions among light harvesting assembles to regulate photosynthetic solar energy conversion. DOE

N81-24208# Massachusetts Univ., Amherst. Dept. of Chemistry.

STRUCTURE AND STABILITY OF COAL-OIL MIXTURES AND COAL-WATER MIXTURES Final Report

R. L. Rowell Feb. 1981 47 p refs Sponsored by Electric Power Research Inst.

(EPRI Proj. 1030)

(EPRI-CS-1695) Avail: NTIS HC A03/MF A01

It was found that a desirable COM dispersion was a loosely flocculated network of coal particles that gave a homogeneous system that yielded readily to flow. The subsidence technique illustrated the concept of critical solids concentration and showed the effect of water as a dispersant in coal mineral oil mixtures. Pycnometric measurements showed that the true coal density could be obtained by extrapolation to infinite dilution. Another finding was that the desirable effects of additives on COM stability were negated by exposure of the pulverized coal to CO2 gas prior to slurry preparation but that N2 gas could be used as an inert blanket without deleterious results. The main device developed was a sedimentation column based partly on measurements of subsidence, pycnometry, and solvent extraction. The evidence supporting surfactant adsorption is the mechanism involved in the formation of the loosely flocculated network of a stabilized COM is discussed. DOE

N81-24209# Florida State Univ., Tallahassee. Dept. of Chemistry.

RESEARCH IN ACTINIDE CHEMISTRY Progress Report, 1 Mar. 1980 - 28 Feb. 1981

Gregory R. Choppin 1981 18 p

(Contracts DE-AS05-76ER-01797; EY-76-S-05-1797)

(DOE/ER-01797/96) Avail: NTIS HC A02/MF A01

Visible spectroscopy, NMR spectroscopy, potentiometry, and calorimetry were used in lanthanide studies which allowed much more thorough interpretation of actinide tracer studies. In the last several years, the studies were expanded to include actinides in the IV, V, and VI oxidation states. Part of the research was directed to investigation of actinide interaction with naturally occurring polyelectrolytes such as humic and fulvic acids. Since redox reactions seemingly occur in some of these interactions, a study of plutonium and neptunium redox behavior in the presence of organic complexing agents was started. Preliminary data are given for reduction of Np(VI) by various organic acids. DOE

N81-24210# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.

CHEMISTRY AND MORPHOLOGY OF COAL LIQUEFACTION Annual Report, 1 Oct. 1979 - 30 Sep. 1980

H. Heinemann Sep. 1980 36 p refs

(Contract W-7405-eng-48)

(LBL-12308) Avail: NTIS HC A03/MF A01

Experimental results are reported in the areas of hydrogen transfer mechanisms and catalysis and organo-metallic chemistry. A few of the significant results in these and other areas are the evidence for catalysis in hydrogen transfer from tetralin; a novel and possibly very important new synthesis of alkyl aromatics from benezene, carbon monoxide, and hydrogen; the study of coals in the transmission electron microscope identifying coal macerals, minerals and metals, and leading to the possibility of observing location of and catalytic influences on pyrolysis and hydrogenation at elevated temperatures; the finding that scales formed on deactivated cobalt-molybdena-alumina-hydrogenation catalysts contain not only metals from the liquid feedstocks, but also molybdenum sulfide which must derive from migration from the catalyst interior to and beyond the surface. Insights gained in mechanisms of pyrolysis, hydrogenation, hydrogen transfer, and indirect liquefaction of coal promise to lead to improving technology by defining problem areas and showing routes to by-pass problems. DOE

N81-24211# Forschungsinstitut fuer Edelmetalle und Metallchemie, Schwaebisch Gmuend (West Germany).

ELECTROLYTICAL HYDROGEN GENERATION UNDER ZERO GRAVITY. HYDROGEN BUBBLE EXPERIMENT IN THE TEXUS 1 PROJECT Final Report

Wolfgang Wopersnow and Christoph Julius Raub Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 36 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forshung und Technologie

(BMFT-FB-W-79-31; ISSN-0170-1339) Avail: NTIS HC A03/MF A01

Hydrogen generation on a half gold-plated Pt cathode in a Na2SO4 water solution contained in a cell was studied photographically. Bubbles formed on the Au and Pt surfaces under zero gravity were found to be smaller than those formed at 1g. Hydrogen bubbles generated at zero-g remained in front of the cathode surface. The cell voltage did not change during the experiment. Hydrogen and a layer of copper and copper oxide were deposited on the cathode. Subsequent residual gravity of 0.0001-g imparts a small amount of motion to the bubble agglomerates. Author (ESA)

N81-24212# Fritz-Haber-Institut, Max-Planck-Gesellschaft, Berlin-Dahlem (West Germany).

PHASE SEPARATION OF HELIUM 2 IN ZERO GRAVITY Progress Report

Hans-Dietrich Denner, Gustav Klipping, Ingrid Klipping, Klaus Lueders, Juergen Menzel, Udo Ruppert, and Harry Walter Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 82 p refs In GERMAN; ENGLISH summary Presented at GIRL Exptl. Meeting, Berlin, 20-21 Jun. 1979 Sponsored by Bundesministerium fuer Forschung und Technologie Prepared in cooperation with Freie Univ.

(BMFT-FB-W-79-47; ISSN-0170-1339) Avail: NTIS HC A05/MF A01

The development of a helium 2 cooling system with an operational temperature < or = 2K for space applications is described. Infrared space astronomy applications require the continuous evaporation of controlled amounts of coolant. The fountain effect assures phase separation. The cryogenic components are optimized. The action of porous plugs is compared with that of an annular gap of adjustable length (active phase separator). The results are examined in terms of the two fluid model. A design concept associating an active phase separator with electrodynamic actuation is explained. It allows a wide range of cooling powers and is of high sensitivity. Author (ESA)

N81-24213# Prins Maurits Lab. TNO, Rijswijk (Netherlands).

MINIMUM IGNITION ENERGY OF F40 AIRCRAFT FUEL/AIR MIXTURES [MINIMALE ONTSTEEKENERGIE VAN EEN VLIEGTUIG-BRANDSTOF F40-LUCHTMENGSEL]

J. vantHoff Aug. 1978 13 p ref In DUTCH

(PML-1978-22) Avail: NTIS HC A02/MF A01

Fuel/air mixtures were ignited in a chamber at 20 C to determine the necessity for using spark free tools during aircraft refuelling. The most readily ignited concentration was 1.15 l/cum. At an electrode distance of 1.7 mm the ignition energy was found to lie between 3.4 mJ and 3.7 mJ. The composition of F40 fuel is shown to differ from sample to sample.

Author (ESA)

N81-24214# Bureau of Mines, Reno, Nev. Reno Research Center.

PRODUCING ALUMINA FROM CLAY BY THE HYDROCHLORIC ACID PROCESS, A BENCH SCALE STUDY, REPORT OF INVESTIGATION, 1980

J. A. Eisele 1980 28 p refs

(PB81-148157; BM-RI-8476; LC-80-14370) Avail: NTIS HC A03/MF A01 CSCL 07A

Bench scale cyclic tests were conducted to determine the composition of recycled leach liquor in the bureau's proposed clay/HCl leach/HCl sparge process for producing Al2O3 from clay. The data developed from these tests make it possible to synthesize leach liquors for predetermined steady state operating conditions when conducting large scale crystallization tests. GRA

N81-24215# Ionomet Co., Brighton, Maine.
VAPOR DEPOSITED SILVER HALIDES FOR THIN LAYER CHROMATOGRAPHY Final Report, 1 Oct. 1979 - 31 Mar. 1980
Gershon M. Goldberg Mar. 1980 17 p
(Grant NSF PFR-79-17476)
(PB81-148959; NSF/RA-800317) Avail: NTIS HC A02/MF A01 CSCL 07D

Experiments were designed to determine the potential of using vapor deposited silver halide layers as a thin layer chromatography (TLC) medium to effect separations of compounds difficult to separate on presently available TLC media. Objectives included: to find the most effective silver halide; to determine the influence of surface area of the deposit on separation efficiency; and to determine whether a reverse phase media could be prepared. Research methodology involved evaporating silver bromide and silver chloride on substrates of varying surface areas and then separating compounds capable of forming salts or complex ion with silver ion. Commercial materials were evaluated as media for separations. Direct spectrophotometry and photographic development were employed as detection techniques. GRA

N81-24216# Bureau of Mines, Albany, Oreg. Albany Research Center.
A SIMPLE, LOW-COST METHOD FOR THE DISSOLUTION OF METAL AND MINERAL SAMPLES IN PLASTIC PRESSURE VESSELS, REPORT OF INVESTIGATIONS, 1980
R. F. Farrell, S. A. Matthes, and A. J. Mackie 1980 20 p refs
(PB81-149049; BM-RI-8480; LC-80-607936) Avail: NTIS HC A02/MF A01 CSCL 07D

A general method was developed for preparing solutions from a wide range of metal and mineral samples for chemical analysis. The development of the method from current knowledge of vessel material, pressure dissolution techniques, and the fluoride-boric acid reaction is given. A copper slag and a steelmaking slag treated using this method were analyzed by atomic absorption spectroscopy, yielding values for Si, Mg, Ca, Al, Fe, Mn, Na, As, Pb, Sb, and Zn very close to certified values with an average relative standard deviation of 2.13 pct. The low cost, reduction in preparation time, ease and safety of sample handling, conservation of reagents, and ability to dissolve volatile materials without loss make this method superior to traditional wet digestion techniques for many materials, and ideal for use with atomic absorption, and optical emission or X-ray emission spectroscopy. GRA

N81-24217# EIC, Inc., Newton, Mass.
ELECTROCHEMICAL EVALUATION OF THE ELECTRONIC AND TRANSPORT PROPERTIES OF SILICON, PHASE 1 Final Report, 1 Oct. 1979 - 31 Mar. 1980
R. D. Rauh, R. H. Micheels, and R. Schiff Mar. 1980 25 p refs
(Grant NSF DAR-79-17409)
(PB81-148926; NSF/RA-800312) Avail: NTIS HC A02/MF A01 CSCL 07D

Measurement of the minority carrier diffusion length and the major carrier doping density of p- and n-type samples through the use of a liquid-semiconductor junction in an electrochemical cell was demonstrated. Techniques employed make use of the Schottky-type barrier which forms between semiconductors and certain redox electrolytes. The electrical and optical properties of such a barrier can be used to determine doping densities, as well as carrier lengths, lifetimes, and mobilities. The CH3OH, 1-1/12 redox electrolyte system was chosen because of its stability with respect to silicon passivation and its simplicity of preparation. Surface photovoltage and pulsed space charge capacitance were employed because of their respective insensitivity to surface recombination and surface state effects. GRA

N81-24218# Environmental Protection Agency, Washington, D.C. Office of Pesticides and Toxic Substances.
SUPPORT DOCUMENT, TEST DATA DEVELOPMENT STANDARDS, PHYSICAL/CHEMICAL AND PERSISTENCE CHARACTERISTICS: DENSITY/RELATIVE DENSITY, MELTING TEMPERATURES, VAPOR PRESSURE, OCTANOL/WATER PARTITION COEFFICIENT, SOIL THIN LAYER CHROMATOGRAPHY. PROPOSED RULE, SECTION 4, TOXIC SUBSTANCES CONTROL ACT
George T. Armstrong, Robert H. Brink, and Asa Leifer Oct. 1980 147 p refs
(PB81-141616; EPA-560/11-80-027) Avail: NTIS HC A07/MF A01 CSCL 07D

The data on these physical/chemical characteristics is used to evaluate the manner and extent of environmental transport, fate and places of deposit as an aid in assessing health and environmental effects of chemicals under TSCA. For density/relative testing, an analysis is given of available methods of determining this property of particular classes of materials with different physical characteristics. For melting temperature testing, available methods are analyzed in terms of materials with different physical characteristics. For vapor pressure, two procedures are given, the isoteniscope procedure for pressures of 0.1 to 100 kPa and a gas saturation procedure for pressures of .00001 to the 1,000 Pa. The Knudsen effusion procedures are also given. GRA

N81-24219# Bureau of Mines, Avondale, Md.
CHARACTERIZATION OF THIN FILMS AND SOLID SURFACES USING PROTON-INDUCED X-RAY EMISSION Report of Investigations, 1980
Bruce D. Sartwell and Arthur B. Campbell, III 1980 27 p refs
(PB81-147407; BM-RI-8455) Avail: NTIS HC A02/MF A01 CSCL 07D

Characteristic X-rays produced by proton bombardment of a solid surface are used to provide quantitative compositional analyses of surface layers of metals. An integral X-ray yield equation was developed that quantitatively relates the measured X-ray yield to the thickness of thin films ranging from less than a monolayer to several thousand angstroms. The use of the integral yield equation is demonstrated for the growth or a thin film by vacuum evaporation. Results presented show how proton induced X-ray emission (PIXE) was used to determine the oxidation kinetics of iron that had been implanted with several different species of heavy ions. The sensitivity of PIXE for the measurement of very thin film growth kinetics is demonstrated from studies of the effect of fractional monolayer coverages of sulfur on the initial oxidation kinetics of iron. GRA

N81-24220# Bureau of Mines, Pittsburgh, Pa.
SPONTANEOUS COMBUSTION SUSCEPTIBILITY OF U.S. COALS Report of Investigations, 1980
J. M. Kuchta, V. R. Rowe, and D. S. Burgess 1980 44 p refs
(PB81-150039; BM-RI-8474) Avail: NTIS HC A03/MF A01 CSCL 08I

The chemical and thermal criteria used for predicting the spontaneous combustion hazard are briefly reviewed and data are presented to characterize the gas desorptions and self heating tendencies of 29 U.S. coals. Closed vessel desorption experiments showed that CO, CO2 and CH4 are the main gases evolved and that the CO, CO/delta O2 index, and O2 absorption rate increase with decreasing rank and increasing oxygen content of the coal. The effects of temperature, moisture and other variables are discussed together with the application of the data to the complex conditions encountered in a mining environment. An important finding is that the presence of CO alone in a mine is not necessarily an indication of a self-heating reaction of the coal. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N81-24221 Stanford Univ., Calif.
PREDICTION OF SOLUBILITIES, DIFFUSIVITIES, AND EFFECTS OF SURFACE ACTIVE ELEMENTS ON KINETICS OF GASES IN LIQUID IRON ALLOYS Ph.D. Thesis
Chang-Hwang Hua 1981 352 p
Avail: Univ. Microfilms Order No. 8108948

The diffusivities and solubilities of hydrogen in multicomponent liquid iron alloys were studied by a combination of

steady and unsteady state gas-liquid metal diffusion cell techniques. The rates of absorption of hydrogen in stagnant liquid iron alloys were found to be controlled by diffusion of gas in the melt. Appropriate solutions of Fick's first and second laws were used to examine the data and calculate the solubilities and diffusivities of hydrogen. Based on binary system data, predictive methods for the diffusion coefficient of hydrogen, the activity coefficient and thereby the solubility of hydrogen, in the complex liquid iron alloys containing up to 60 wt percent of alloying elements were developed, tested and found to work. The overall errors in diffusivity and solubility values predicted by this method were +0.74 percent and +1.14 percent respectively for multicomponent alloys up to 60 percent total alloy content. A table of improved interaction parameters for all common alloying elements was derived. Dissert. Abstr.

N81-24222 Case Western Reserve Univ., Cleveland, Ohio.
FACTORS INFLUENCING STEEL SOLIDIFICATION STRUCTURES Ph.D. Thesis
Donald James Hurtuk 1981 156 p
Avail: Univ. Microfilms Order No. 8109589

An investigation has been conducted to combine laboratory and industrial experiments to study the solidification of steels, particularly as it relates to the continuous casting of low alloy steel. Industrial experiments involved the evaluation of etched cross sections of blooms in the as-cast condition from over 125 casts and the subsequent computer analysis of these data. Laboratory experiments involved producing unidirectionally solidified small ingots of steel, Fe-C alloys, and Fe-Ni alloys. Results from the industrial experiments revealed a direct relation between the lenght of the columnar dendritic zone and the frequency and severity of casting defects in blooms. A clear relationship was established between the carbon concentration of the steel and the length of the columnar zone in these castings. Laboratory results indicate that carbon content exerts a significant effect on solidification structures of steel and Fe-C alloys creating three regions of solidification behavior as measured by various solidification parameters including columnar zone length, heat transfer, thermal gradient, rate of solidification, and dendrite spacing. Dissert. Abstr.

N81-24223# Case Western Reserve Univ., Cleveland, Ohio.
MICROSTRUCTURE OF Al2O3 SCALES FORMED ON NiCrAl ALLOYS Ph.D. Thesis
James Leo Smialek 1981 290 p
Avail: Univ. Microfilms Order No. 8109610

The structure of transient scales formed on pure and Y- or Zr-doped Ni-15Cr-13Al alloys oxidized for 0.1 hr. at 110 C was studied by the use of transmission electron microscopy. Crystallographically oriented scales were found on all three alloys, but especially for the Zr-doped NiCrAl. The oriented scales consisted of alpha (Al,Cr)2O3, Ni(Al,Cr)2O4, and gamma Al2O3. They were often found in intimate contact with each other such that the closepacked planes and directions of one oxide phase were aligned with those of another. The prominent structural features of the oriented scales were approximately 0.1 micrometer subgrains; voids, antiphase domain boundaries and aligned precipitates were also prevalent. Randomly oriented alpha Al2O3 was also found and was the only oxide ever observed at the immediate oxide-metal interface. These approximately 0.15 micrometer gains were populated by intragranular voids which decreased in size and number towards the oxide-metal interface. A sequence of oxidation was proposed in which the composition of the growing scale changed from oriented oxides rich in Ni and Cr to oriented oxides rich in Al. Dissert. Abstr.

N81-24224 Illinois Univ. at Urbana-Champaign.
STUDIES OF SURFACE DIFFUSION Ph.D. Thesis
David Allen Reed 1980 165 p
Avail: Univ. Microfilms Order No. 8108634

The relationship between the diffusion coefficient D and the jump rate is examined. Computer simulation were done for several different interatomic potentials. It is demonstrated that the activation energy for diffusion and jumping may be significantly different. The time correlation of concentration fluctuations as a measure of the diffusion coefficient is examined. Also investigated by Monte Carlo methods are several problems important in field ion microscopic studies of the motion of individual atoms. Corrections to the estimated mean-square displacement, to account for the boundaries of the surface, are discussed for one- and two-dimensional diffusion under a variety of conditions. The accuracy of and optimal conditions for measuring the pair of potential of adatoms from their pair separation distribution is also considered. Experiments to establish the fundamental step length in surface diffusion are tested by Monte Carlo simulations. The diffusion of two rhenium adatoms in the same channel of the (211) plane of tungsten is investigated. Dissert. Abstr.

N81-24225 Drexel Univ., Philadelphia, Pa.
FATIGUE OF HIGH STRENGTH POWDER METALLURGY ALUMINUM ALLOYS Ph.D. Thesis
Mario Rafalin 1981 257 p
Avail: Univ. Microfilms Order No. 8110559

The fatigue response of fully-dense-high-strength powder metallurgy aluminum alloys (Al-Cu-Zn-Mg-Co) was evaluated in laboratory air and in a salt fog (3.5 percent NaCl solution) environment. Particular emphasis was given to the interplay of the mode of powder processing and the cobalt level (up to 0.8 percent) on microstructure and fatigue behavior. Anisotropy in fatigue response was observed for each cobalt level and processing mode, with the highest fatigue life in the longitudinal orientation. Dissert. Abstr.

N81-24226 Rensselaer Polytechnic Inst., Troy, N. Y.
THE EFFECT OF INERT OXIDE PARTICLES ON THE MARTENSITE TRANSFORMATION IN Fe-Ni ALLOYS Ph.D. Thesis
Peter Jeffrey Brofman 1980 177 p
Avail: Univ. Microfilms Order No. 8109308

Dispersion strengthened Fe-Ni alloys, prepared by powder metallurgical techniques, were used to evaluate the relative effects of M(s) chemical driving force, and austenite yield strength on resultant martensite morphology without altering matrix chemistry. An addition of 2 volume percent yttrium oxide dispersion, coupled with austenite grain refinement from about 100 to 2 micrometers depressed the M(s) temperature from 66 to -25 C. At the lowest austenitizing temperature of 600 C, dispersion strengthening was sufficient to induce a shift in morphology while holding constant both matrix chemistry and thermal history. An internally twinned lath martensite was observed. Lath martensite was observed at an austenite yield strength of over 50 ksi (345 MPa) and a thermodynamic driving force of 350 cal/mole, well in excess of previously reported transition values for the Fe-Ni system. The transition to plate martensite occured in an M(s) range of -2 to -25 C. It is concluded that the observed transition from lath to plate martensite was induced primarily by the depression of M(s) temperature into the plate-forming temperature regime of the Fe-Ni system. Dissert. Abstr.

N81-24227 Minnesota Univ., Minneapolis.
THERMODYNAMIC PROPERTIES FOR IRON AT VERY HIGH PRESSURES: IMPLICATIONS FOR THE EARTH'S CORE Ph.D. Thesis
John Michael Brown 1980 149 p
Avail: Univ. Microfilms Order No. 8109396

Results from two shock wave experimental programs are reported, giving new data for the thermodynamics, elastic properties, and melting behavior of iron under pressures in excess of 100 GPa. These data are combined in a preliminary thermal model for the core. Melting in iron was detected at high pressure. Release wave velocities were measured with the overtaking rarefaction method. Upon melting the shear modulus becomes zero leading to a decrease in the acoustic wave velocity behind the shock front. Dissert. Abstr.

N81-24228 American Univ., Washington, D. C.
ON THE QUESTION OF ENERGY TRANSFER DURING THE CORROSION REACTION OF ALUMINUM Ph.D. Thesis
Trung Hung Nguyen 1980 150 p
Avail: Univ. Microfilms Order No. 8109703

The corrosion reaction of aluminum as studied with three different techniques: the impressed polarization technique devised by Engell-Stolica, the adsorption and dissolution test, and scrape potential measurement studies. A potential energy diagram was tentatively sketched for the first time. Dissert. Abstr.

N81-24229 Oregon Graduate Center for Study and Research, Beaverton.
EFFECT OF MICROSTRUCTURE ON INTERNAL AND EXTERNAL HYDROGEN EMBRITTLEMENT OF AN ULTRA-HIGH STRENGTH STEEL Ph.D. Thesis
Dilipkumar D. Dedhia 1980 120 p
Avail: Univ. Microfilms Order No. 8109792

Hydrogen assisted cracking in low alloy ultrahigh strength AISI 4340 steel heat treated to above 200 ksi yield strength was slightly dependent on microstructural features such as grain size, carbide type, amount of retained austenite, and grain boundary composition. The susceptibility of the steel to hydrogen was similar for both internal as well as external hydrogen induced embrittlement. Increasing the prior austenite grain size slightly improved the threshold stress intensity but did not have any effect on region crack growth rates. The change from epsilon carbide to cementite increased the region 2 crack growth rates. The presence of retained austenite slightly improved the threshold stress intensity for hydrogen assisted cracking. However, its thermal and mechanical instability actually increased the region crack growth rates. Dissert. Abstr.

N81-24230*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD FOR DEPOSITING AN OXIDE COATING Patent Application
G. E. McDonald, inventor (to NASA) Filed 23 Mar. 1981 8 p
(NASA-Case-LEW-13131-1; US-Patent-Appl-SN-246772) Avail: NTIS HC A02/MF A01 CSCL 11F

A metal oxide coating is plated onto a metal substrate at the cathode from an acid solution which contains an oxidizing agent. The process is particularly useful for producing solar panels. Conventional plating at the cathode avoids the presence of oxidizing agents. Coatings made in accordance with the invention are stable both at high temperatures and while under the influence of high photon flux in the visible range. NASA

N81-24231# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
SOME CHARACTERISTICS OF THE SELECTIVE DISSOLUTION OF IRON AND NICKEL ALLOYS
J. M. Kolotyrkin (Karpov L. J. Research Inst. for Chemical Chemistry) 1981 18 p refs Transl. into ENGLISH from Abh der Saechsischen Akad. Wiss. (Leipzig), v. 53, no. 1, 1979 p 131-140
(NRC/CNR-TT-1990; ISSN-0077-5606) Avail: NTIS HC A02/MF A01

The use of gamma-spectroscopic procedures, X-ray microanalyzers, and Auger and electron spectroscopy in determining changes in the chemical composition of thin surface layers is demonstrated on the basis of results obtained in an investigation of the anodic dissolution of the binary Fe-28% Cr alloy, of nonsensitized stainless steels, and of a 70% Ni-28% Mo alloy. Results indicate that the views previously held with regard to the passive layer as static structure are erroneous. In reality, that layer represents an extraordinarily dynamic structure in which local disintegrations occur almost without interruption. These disintegrations cause a flaring up of the rate of dissolution. The active surface areas may again be repassivated or become centers for the development of pitting. A.R.H.

N81-24232# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
MATERIALS RESEARCH FOR ADVANCED INERTIAL INSTRUMENTATION. TASK 1: DIMENSIONAL STABILITY OF GYROSCOPE STRUCTURAL MATERIALS Technical Report, 1 Oct. 1979 - 30 Sep. 1980
K. Kumar, J. McCarthy, F. Petri, and J. Wollam Dec. 1980 77 p refs
(Contract N00014-77-C-0388)
(AD-A098165; R-1433; TR-3) Avail: NTIS HC A05/MF A01 CSCL 11/6

Additional microyield measurements on HIP-50 beryllium samples, subjected to a variety of selected heat treatments, were performed. It was determined that of the several treatments that were employed the most significant increase in the value of the microyield strength occurred from a 100 hour exposure to 600 C. A microyield value of about 26.5 klb/sq in. was measured after this treatment compared to an as-received value of 17.2 klb/sq in. Examination of the microyield data plotted on logarithmic coordinates showed that if a correlation is desired between the processes of microyield and microcreep, one must take into account the value of the strain exponent (which is the slope of the straight line) in the low strain regime, in addition to the measured value of the microyield strength. Experiments performed in this study showed that considerable care should be exercised in the preparation of samples for microstructure examination to avoid introducing mechanical damage in regions near the surface. Optical microscopy was found to have limited utility in determining the effects of the several thermal treatments on sample microstructure. Transmission electron microscopy, however, was successfully performed after jet-thinning the samples in a chromic-acetic acid electrolyte. The differences observed were mainly related to phase precipitation and segregation. Attempts to identify these precipitates are planned for the future. GRA

N81-24233# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
MATERIALS RESEARCH FOR ADVANCED INERTIAL INSTRUMENTATION. TASK 2: GAS BEARING MATERIAL DEVELOPMENT Technical Report, 1 Oct. 1979 - 30 Sep. 1980
D. Das, K. Kumar, E. Wettstein, and J. Wollam Dec. 1980 108 p refs
(Contract N00014-77-C-0388)
(AD-A098229; R-1434; TR-3) Avail: NTIS HC A06/MF A01 CSCL 11/6

Progress is reported on three fronts: boron deposition on beryllium by chemical vapor deposition (CVD) and subsequent reactive diffusion of the deposited boron film, ion implantation of boron into beryllium, and beryllium-ceramic composite materials. CVD coatings of boron, from B2H6 on beryllium at 700 C showed less tendency to crack and spall at a 5 micron thickness than did previous coatings 1 micron thick which had been deposited at 900 C and 950 C. Hardness also increased for the lower temperature thicker films; 2500 KHN versus 1400 KHN. Improved beryllium surface coverage resulted from redesigning the CVD processing chamber to minimize oxygen contamination by providing for vacuum bake out. Films of 10 micron, 3000 KHN, are now obtained without cracking or spalling. metallography electron diffraction and Auger analysis suggest that the coatings consist of an amorphous outer layer of boron with a layer of mixed beryllium borides at the interface. Heat treatment at 900 C for several hours brought about conversion to BeB6. Future studies will use more rigorous conditions in an attempt to form BeB2, with the objective of allowing selection of B, BeB2, or BeB6 as a gas bearing surface. Emphasis will also be placed on generation of new information pertaining to diffusion kinetics in the Be-B system. GRA

N81-24234# California Univ., Los Angeles. School of Engineering and Applied Science.
SYSTEMATIC WEAR/CORROSION STUDY ANALYSIS OF ION PLATED SURFACES Final Report, 8 Jul. 1979 - 31 Jul. 1980
P. Agarwal, P. Nath, H. J. Doerr, R. F. Bunshah, and G. Kuhlman (Naval Engineering Support Office, San Diego, Calif.) 24 Feb. 1981 34 p refs
(Contract N62269-79-C-0283)
(AD-A097813; UCLA-ENG-8043; NADC-80222-60) Avail: NTIS HC A03/MF A01 CSCL 11/3

This study deals with the improvement in localized corrosion resistance and wear reduction of type M-50 steel used in engineering components such as bearings by use of overlay coating. Overlay coating materials selected for the improvement in localized corrosion (pitting) were titanium, chromium, nichrome (Ni-20Cr) and molybdenum deposited by physical vapor deposition techniques of direct evaporation (E), activated evaporation (AE), i.e., evaporation in the presence of a plasma, and ion plating (IP), and titanium carbide, titanium nitride and hafnium nitride coatings deposited by the activated reactive evaporation process (ARE). Coated and control (uncoated) samples of M-50 steel were corrosion tested. The results showed that the control (uncoated) samples were severly pitted along the contact line and general corrosion occurred outside this region, whereas the samples with overlay coatings of titanium, chromium, nichrome

(Ni-20CrO, TiC, and TiN completely eliminated the localized pitting corrosion. GRA

N81-24235# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Materials Engineering.

MECHANISMS OF CORROSION FATIGUE OF ALUMINUM ALLOYS

David J. Duquette Apr. 1981 15 p refs
(Contract N00014-75-C-0466)
(AD-A097912) Avail: NTIS HC A02/MF A01 CSCL 11/6

An overview of experimental variables which are considered critical to understanding the mechanisms of corrosion fatigue of high strength aluminum alloys is presented. Based on this overview, an examination of previously proposed mechanisms is attempted. These models include anodic dissolution, surface energy reduction, and hydrogen embrittlement. It is concluded that hydrogen embrittlement of process zones at alloy surfaces (for crack initiation) and at crack tips (for crack propagation) best explains observed results. A general model of corrosion fatigue of these alloys is proposed. This model suggests that the nature of the naturally formed oxide film on aluminum alloys may be a critical factor. Chemical or mechanical damage of the film allows hydrogen ingress. The presence of second phase particles which may act as sinks for dislocation transported hydrogen, may also be a necessary prerequisite to significant amounts of reduction in fatigue resistance associated with corrosion. Author (GRA)

N81-24236# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.

EFFECTS OF A MAGNETIC FIELD ON HYDROGEN EVOLUTION REACTION AND ITS DIFFUSION IN IRON AND STEEL Progress Report

V. S. Agarwala and J. J. DeLuccia 10 Mar. 1981 20 p refs
(AD-A097848; NADC-81029-60) Avail: NTIS HC A02/MF A01 CSCL 11/6

The presence of hydrogen in high strength steels results in catastrophic failure of a part much below its threshold strength. Chemical cleaning, finishing and electroplating processes generally introduce critical amounts of hydrogen in metals. In the present work, an attempt has been made to retard hydrogen entry into the metal from such treatments by the use of a magnetic field. Experiments have shown that the effects of an applied magnetic field have affected both the hydrogen evolution reaction process and its diffusion in both Armco iron and high strength 4340 steel. Author (GRA)

N81-24237# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.

STRESS-INDUCED HYDROGEN CONCENTRATION IN TITANIUM Final Report, 1 Jan. 1976 - 1 Jan. 1981

Philip N. Adler and Robert L. Schulte Mar. 1981 119 p refs
(Contract F44620-76-C-0071; AF Proj. 2306)
(AD-A098100; RE-624; AFOSR-81-0401TR) Avail: NTIS HC A02/MF A01 CSCL 11/6

The changes in hydrogen concentration that accompany application of a stress-gradient were characterized in titanium alloys so that the influence of stress on hydrogen embrittlement can be understood. In situ measurement of hydrogen was made useing the nuclear microprobe for hydrogen (NMH). A nondestructive depth-profiling technique that utilizes the IH(7Li, gamma)8Be resonant nuclear reaction. Stress gradients were applied by four-point bending. Single phase alloys of beta-Ti and alpha-Ti, as well as different alpha/beta morphologies of Ti-6Al-4V alloy, were examined. Hydrogen redistribution was observed in all the beta-phase alloys under an elastic stress gradient, but no further change accompanied plastic deformation. The extent of hydrogen change in high-purity alloys was approximately two times greater than in commercial alloys. Based on this difference and measurements of the partial molal volume of hydrogen in selected alloys, it was concluded that a portion of hydrogen in the commercial alloys was not available for redistribution and was, therefore, trapped. Factors such as hydrogen content, oxygen content, and cold working were not found to change the extent of hydrogen trapping. The practical significance of trapping lies in its possible use to reduce the deleterious influence of hydrogen. The diffusion coefficient in these alloys was also determined under both elastic and plastic loadings and was found to be relatively uniform, approximately 1 time 10 to the minus 6 sq cm. per s, and consistent with those previously reported for beta-Ti. GRA

N81-24238# Westinghouse Research and Development Center, Pittsburgh, Pa. Materials Engineering Dept.

CONTRACT WEC 3.2.3 STUDY TO OPTIMIZE Cr-Mo STEELS TO RESIST HYDROGEN AND TEMPER EMBRITTLEMENT Annual Report, 1 Jan. - 31 Dec. 1980

B. J. Shaw 20 Jan. 1981 44 p refs
(Contract DE-AC05-78ET-13513)
(DOE/ET-13513/T8; QR-9; AR-2) Avail: NTIS HC A03/MF A01

The effect of compositional variables (Mo, Cr, Mn, Si, C, and P) on the susceptibility of the steels to temper and hydrogen embrittlement was investigated. The statistically designed set of 32 heats were tempered to two strength levels. Unbrittled Charpy specimens and blanks to be temper embrittled were machined from both strength levels. Concurrently 1T-compact tension specimens were machined from the high strength steels. The first two hydrogen sulfide-saturated water vapor environment tests on these steels were started. E.D.K.

N81-24239# General Atomic Co., San Diego, Calif.

EFFECTS OF A RANGE OF MACHINED AND GROUND SURFACE FINISHES ON THE SIMULATED REACTOR HELIUM CORROSION OF SEVERAL CANDIDATE STRUCTURAL MATERIALS

L. D. Thompson Feb. 1981 45 p refs
(Contract DE-AT03-76ET-35301)
(GA-A-15674) Avail: NTIS HC A03/MF A01

The corrosion behavior of several candidate reactor structural alloys in a simulated high temperature gas cooled reactor (HTGR) environment over a range of lathe machined and centerless ground surface finishes is discussed. Surface finish variations did not affect the simulated advanced HTGR corrosion behavior of the materials. The availability of reactant gaseous impurities controls the kinetics of the observed gas-metal interactions. Variations in the near-surface activities and mobilities of reactive solute elements, such as chromium, which might be expected to be affected by changes in surface finish, do not seem to greatly influence corrosion in this simulated advanced HTGR environment. DOE

N81-24240# Ames Lab., Iowa.

COAL FLY ASH; A POTENTIAL RESOURCE FOR ALUMINUM AND TITANIUM

J. R. Frederick, M. J. Murtha, and G. Burnet 1980 24 p refs Presented at the 180th ACS Meeting/2. Chem. Congress of the N. Am. Continent, Las Vegas, Nev., 24-26 Aug. 1980
(Contract W-7405-eng-82)
(IS-M-298; CONF-800814-32) Avail: NTIS HC A02/MF A01

Two processes are described which utilize fly ash as a source of metals and by products. The lime soda sinter process involves sintering of the fly ash and alkaline oxides at 1100 to 1300 C to break the alumina silica bonds and form soluble aluminate compounds and insoluble calcium silicates. The aluminates are extracted from the sinter by dissolution in sodium carbonate. The calcium silicate sinter extract shows promise as a raw material for the manufacture of portland cement. The HiChlor process uses high temperature chlorination of fly ash in the presence of a reductant to form volatile metal chlorides of aluminum, titanium, iron, and silicon. The HiChlor process extracts aluminum, titanium, and iron, while the sinter process extracts only aluminum. DOE

N81-24241# California Univ., Livermore. Lawrence Livermore Lab.

CORROSION BEHAVIOR OF MATERIALS EXPOSED TO HYPERSALINE GEOTHERMAL BRINE

R. D. McCright 20 Nov. 1980 18 p refs Presented at the Corrosion/81st Ann. Meeting, Toronto, 6-10 Apr. 1981
(UCRL-85174; CONF-810402-4) Avail: NTIS HC A02/MF A01

The corrosion rate and corrosion attack characteristics were determined for thirteen commercially available materials exposed in a geothermal production well for three months. The materials included carbon steels, Cr-Mo alloy steels, martensitic and ferritic stainless steels, high-nickel alloys, and titanium. The

environment at the 1800 ft depth of exposure was a single phase high salinity brine. The prevailing temperture was 260 C and the prevailing pressure was 630 psi during the exposure period. Results indicated that the carbon steels suffered intense generalized and localized corrosion. Addition of Cr and Mo to steels imparted significant improvement in the corrosion performance in this aggressive environment. Of the stainless steels tested, the most resistant were those containing a few percent molybdenum. DOE

N81-24242# Brookhaven National Lab., Upton, N. Y.
STRESS-CORROSION CRACKING OF SENSITIZED STAINLESS STEEL BY SULFUR-CONTAINING COMPOUNDS
H. S. Isaacs, B. Vyas, and M. W. Kendig 1981 22 p refs Presented at Corrosion/1981 Ann. Meeting, Toronto, 6 Apr. 1981
(Contract DE-AC02-76CH-00016)
(BNL-28680; CONF-810402-3) Avail: NTIS HC A02/MF A01

The stress corrosion cracking (SCC) of sensitized Type 304 stainless steel in thiosulfate solutions has been studied using constant extension rate tests. Very low concentrations of about 6.10 x 10 to the minus 7th power M (0.1ppm) gave cracking. With boric acid added, higher concentrations (1ppm) were required. The SCC was shown to be electrochemically controlled. Below -0.5v sub SCE (-0.75 sub SHE) no SCC took place; above this potential the rate of SCC increased with potential. An induction period was required before SCC continued above -0.5v if the potential was held at or below this value for extended times. This period was associated with the build up of an aggressive solution of thiosulfate decomposition products within the crack. The cracking process has been considered to be controlled by rupture of a salt layer and not a passivating oxide. DOE

N81-24243# Battelle Pacific Northwest Labs., Richland, Wash.
EVALUATION OF METALLIC MATERIALS FOR USE IN ENGINEERING BARRIER SYSTEM
S. G. Pitman, B. Griggs, and R. P. Elmore 1980 8 p refs Presented at 3rd Ann. Meeting of the Mater. Res. Soc., Boston, 17 Nov. 1980
(Contract DE-AC06-76RL-01830)
(PNL-SA-8939; CONF-801124-41) Avail: NTIS HC A02/MF A01

Inconel, Incoloy, Hastelloy C-276, and titanium alloys all had excellent corrosion resistance in all postulated repository environments tested. Further work is required to evaluate the pertinent enviro-mechanical properties of these materials; the mechanical properties of grade 2 titanium are better than those of grade 12 titanium, except the tensile and yield strengths. These properties include fatigue crack growth rate, environment fatigue crack growth rate, fracture toughness, impact toughness, and dynamic fracture toughness; there is no evidence in the current data to indicate that the simulated repository environment is aggresive to grade 2 12 titanium. This include data from corrosion fatigue crevice corrosion, wedge loaded cracked specimens, and residual stress specimens. DOE

N81-24244# Colorado School of Mines, Golden.
FERROUS ALLOY METALLURGY: LIQUID LITHIUM CORROSION AND WELDING Progress Report, 1 Jan. - 31 Dec. 1980
D. L. Olson and D. K. Matlock 1980 62 p refs
(Contracts DE-AS02-76ER-02313; EY-76-S-02-2313)
(DOE/ER-02313/T1) Avail: NTIS HC A04/MF A01

Fatigue crack growth was used to evaluate the interaction between liquid lithium and an imposed stress. Fatigue crack growth data on type 304L stainless steel at 700 C and 2 1/4 Cr-1 Mo steel between 500 and 700 C show that for all imposed test conditions (i.e., frequency, temperature, and nitrogen content in the lithium) the interaction of lithium with the strain at the crack tip results in enhanced crack growth rates. The enhanced growth rates result from the effects of either enhanced grain boundary penetration or a result from the effects of either enhanced grain boundary penetration or a change in crack propagation mechanism due to liquid metal embrittlement. Auger spectroscopy of grain boundary penetrated specimen shows that a lithium oxygen compound forms at the grain boundary. Mossbauer evaluations of the ferrite layer of corroded type 304 stainless steel are used to develop a model for weight loss in liquid lithium. Weldments of 2 1/4 Cr-1Mo steel to 316 stainless steel were investigated for fusion microstructures, thermal expansion impact strength and characterization of specific long time in service failures. DOE

N81-24245# Westinghouse Electric Corp., Pittsburgh, Pa. Research and Development Center.
WEC 3.2.3 STUDY TO OBTIMIZE Cr-Mo STEELS TO RESIST HYDROGEN AND TEMPER EMBRITTLEMENT Annual Report, 1 Jan. - 31 Dec. 1980
Bevil J. Shaw 20 Jan. 1981 44 p refs
(Contract DE-AC05-78ET-13513)
(DOE/ET-13513/T9; QR-9; AR-2) Avail: NTIS HC A03/MF A01

The hydrogen embrittlement susceptibility of commercial 2 1/4 Cr - 1 Mo steels was investigated, using H2S as the primary environment. After it was found that low strength steels, which were given a post weld heat treatment, were immune to the test techniques developed, the effect of strength level was studied to establish a lower limit for embrittlement. Similar tests on the peak hardness zone in the heat affected zone of a weld showed that the crack preferred to move to the far heat affected zone where the strength level was below the lower limit established above. It is suggested that residual stresses may account for the anomaly, although other factors such as structural change could be important. In order to assess the low strength steels, the environment was changed to include saturated water vapor in the H2S. DOE

N81-24246# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
INVESTIGATIONS OF INTERMETALLIC ALLOY HYDRIDING MECHANISMS Annual Progress Report, 1 May 1980 - 28 Feb. 1981
B. R. Livesay and J. W. Larsen 28 Feb. 1981 72 p refs
(Contracts DE-AS05-76ER-05246; E(40-1)-5246)
(DOE/ER-05246/T1) Avail: NTIS HC A04/MF A01

The relations between structural and physical characteristics and the hydrogen interaction kinetics of the AB5 transition metal-rare earth compounds are studied. LaCo5 and LaNi5 were mainly used. Magnetic studies are providing details on the Ni-rich precipitates in LaNi5. Reactions with poison indicate that storage alloy surface segregation results from the chemical potential associated with oxygen at the alloy surface. SEM micrographs show that each LaNi5 particle has a large number of facets. DOE

N81-24247# Thyssen Edelstahlwerke A.G., Krefeld (West Germany). Forschungsinst.
HOT CORROSION OF UNCOATED AND COATED NICKEL-ALLOYS IN HIGH VELOCITY COMBUSTION GASES Final Report
Heinrich Kiesheyer and Guenter Lehnert Bonn Bundesministerium fuer Forschung und Technologie Jun. 1980 50 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-029; ISSN-0340-7608) Avail: NTIS HC A03/MF A01

Various substrate/coating combinations were tested under accelerated sulfidation conditions. The different functioning temperatures encountered with land based and flying turbines lead to the use of various combinations. Severe conditions were chosen. The behavior of an uncoated alloy was studied and compared with that of various chromium diffusion and platinum aluminide coatings. The corrosion characteristics of these various protective coatings were studied as a function of time. Platinum aluminide coatings offer the best performance against sulfidation. Author (ESA)

N81-24248# Centre Technique des Industries Mecaniques, Senlis (France).
PLATING MACHINING STEELS WITH ZINC Final Report [ZINCAGE DES ACIERS DE DECOLLETAGE]
F. Mortier 1 Sep. 1980 22 p In FRENCH
(CETIM-12-F-231) Avail: NTIS HC A02/MF A01

Problems encountered, during zinc electroplating of free-cutting steels were studied and process modifications were tried.

The occurrence of plating flaws reported in industrial literature is surveyed, and particular difficulties, such as plate scaling and pitting, are identified. An experiment was conducted to define optimal electrodeposition procedures was then undertaken. Results reveal that the time needed to achieve zinc plating potential depends on stripping technique used (anodic stripping is recommended), the surface condition of treated parts, and, most importantly, on current density during electrolysis. The optimization of current density in response to persistent plating difficulties is stressed. Author (ESA)

N81-24249# Centre Technique des Industries Mecaniques, Senlis (France).

ELECTRODEPOSITION WITH A PULSATING CURRENT Final Report [DEPOTS ELECTROLYTIQUES COURANT PULSE]

C. Fuvelle Sep. 1980 35 p refs In FRENCH

(CETIM-12-F-291) Avail: NTIS HC A03/MF A01

The effect of a pulsating current on the morphology of metal deposits obtained by electrodeposition was studied. Improved structure, microhardness, brilliance and regularity of the plate surface were objectives Theoretical limitations on pulse current deposition are recalled, including current density, diffusion and transport phenomena. An experiment, involving pulse current nickel electroplating, is described. Results show that the optimal pulse frequency lies between 50 Hz and 100 Hz. A reduction in plate thickness is achieved, while physical characteristics of plate obtained with dc are maintained. Industrial application to gold plating is suggested. Author (ESA)

N81-24250# Centre Technique des Industries Mecaniques, St. Etienne (France).

CHEMICAL PREPARATION OF SURFACES FOLLOWING AFNOR SPECIFICATION NF T76-201 [LES PREPARATIONS DE SURFACE CHIMIQUES PRECONISEES PAR LA NORME AFNOR NF T76-201]

H. Ancenay, D. Benazet, and Y. Noblet 10 Nov. 1980 12 p In FRENCH

(CETIM-N-2X-00-0) Avail: NTIS HC A02/MF A01

Specification NF T76-201 for the preparation of metal surfaces was evaluated in order to justify its application in the qualification of adhesives. Test specimens of steel, stainless steel, brass, zinc, and aluminum were prepared and glued, using three different bonding compounds: epoxy resin, epoxy cement with hardener (HV 998), and polyurethane cement with hardener. The bonds were characterized for shear strength before (qualification) and after aging. Only results of aluminum bonding are satisfactory, the other bonds showing unacceptable failure rates, when NF T76-2001 is applied. Author (ESA)

N81-24251# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.

ELASTIC PLASTIC CHARACTERIZATION OF NUCLEAR VESSEL STEELS

G. Angelino and F. J. Loss (Naval Research Lab., Washington, D.C.) 1980 16 p refs Presented at Intern. Conf. on Anal. and Exptl. Fracture Mech., Rome, 23-27 Jun. 1980 Sponsored in cooperation with US Nuclear Regulatory Commission

(CISE-1637) Avail: NTIS HC A02/MF A01

Elastic-plastic toughness of nuclear vessel steels are characterized by the J-R curve procedure. An A 302-B steel plate having a CV upper shelf energy of 68 J is studied. The behavior of this steel is contrasted with that of other reactor vessel steels of higher toughness, both irradiated and not irradiated, so as to place in perspective the shelf energy value of 68 J. It is concluded that the proposed J-R curve procedure is useful for the assessment of nuclear structural steels of low shelf toughness. The margin of safety against fractures in structures using such a low toughness can be small and requires careful assessment. Author (ESA)

N81-24252# Little (Arthur D.), Inc., Cambridge, Mass.

AVAILABILITY OF CRITICAL SCRAP METALS CONTAINING CHROMIUM IN THE UNITED STATES. WROUGHT STAINLESS STEELS AND HEAT-RESISTING ALLOYS, INFORMATION CIRCULAR, 1980

Charles L. Kusik, Harry V. Makar, and Michel R. Mounier 1980 59 p refs

(Contract DI-BM-J0-188170)

(PB81-148397; BM-IC-8822; LC-80-607147) Avail: NTIS HC A04/MF A01 CSCL 11F

A two part study was conducted to assess the domestic availability of critical metals in scrap containing significant amounts of chromium. Wrought stainless steels and heat-resisting alloys are emphasized. GRA

N81-24253# Bureau of Mines, Reno, Nev. Reno Research Center.

PREPARING RARE EARTH-SILICON-IRON-ALUMINUM ALLOYS REPORT OF INVESTIGATIONS, 1980

J. D. Marchant, E. Morrice, B. P. Herve, and M. M. Wong 1980 16 p refs

(PB81-148140; BM-RI-8445; LC-79-607978) Avail: NTIS HC A02/MF A01 CSCL 11F

An improved procedure for producing rare earth-silicon alloys was investigated. Metallurgical evaluations showed the alloys prepared in this investigation to be as effective in controlling the detrimental effect of sulfur in steel and cast iron as the commercial rare earth-silicon-iron alloys presently used in the steel industry. GRA

N81-24254# Browning Engineering Corp., Hanover, N.H.

EXTREME IMPACT VELOCITY METAL AND CERAMIC DEPOSITION, PHASE 1 Final Report

James A. Browning and Richard W. Whitfield 26 Mar. 1980 100 p refs

(Contract NSF DAR-79-16720)

(PB81-151292; NSF/RA-800307) Avail: NTIS HC A05/MF A01 CSCL 11C

Successful use of internal burner flame jets to accelerate molten metal particles to extreme velocity for high quality coatings is reported. Flame jets were designed and tested in two basic operational modes for producing coatings: (1) an open system used as a particle stream focuser and/or a particle accelerator; and (2) a closed system used both as a particle/wire melter and a particle separator. Powders and wires of a great variety of metals and ceramics were melted by either an oxy-fuel flame, plasma arc torch, or electric arc and introduced into high velocity flame jets. Resulting coatings were metallographically examined revealing that the quality of standard oxy-fuel spray coatings is superior to that of plasma sprayed coatings. Plasma coatings are expected to be better than those deposited by the D-gun when air pressures much higher than the 120 psig are used. GRA

N81-24255 Case Western Reserve Univ., Cleveland, Ohio.

EFFECT OF HEAT TREATMENT ON THE THERMAL FATIGUE BEHAVIOR AND FRACTURE TOUGHNESS OF H13 STEEL FOR ALUMINUM DIE CASTING DIES Ph.D. Thesis

Swapan Kanti Das 1981 190 p

Avail: Univ. Microfilms Order No. 8109578

The effect of different rates of cooling from the austenitizing temperature on the thermal fatigue resistance and fracture toughness of H13 steel designed for use on dies for aluminum die casting was measured. The rates of cooling included; oil quenching to martensite; two different rates of air cooling that produced mixed martensitic and upper bainitic structures; and quenching into molten salts for isothermal transformation to lower bainite. All steels were subsequently tempered to about 46 Rockwell C. A high temperature homogenizing treatment was employed on some of the steels to produce grain boundary carbides in the annealed microstructure. The faster cooling rates from the austenitizing temperature that produced completely martensitic structures exhibited superior thermal fatigue behavior and fracture toughness compared to more slowly cooled steels with mixed bainitic-martensitic structures. Dissert. Abstr.

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N81-24256* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

BIFUNCTIONAL MONOMERS HAVING TERMINAL OXIME AND CYANO OR AMIDINE GROUPS Patent

Robert W. Rosser, Ibrahim M. Shalhoub (San Jose State Univ.), and Hanoi Kwongs, inventors (to NASA) (San Jose State Univ.) Issued 26 May 1981 5 p Filed 30 Apr. 1980 Division of US Patent Appl. SN-028301, filed 9 Apr. 1979
(NASA-Case-ARC-11253-3; US-Patent-4,269,787; US-Patent-Appl-SN-145283; US-Patent-Class-260-465.5R; US-Patent-Class-564-229; US-Patent-Class-528-310; ; US-Patent-Appl-SN-028301) Avail: US Patent and Trademark Office CSCL 07C

The preparation of crosslinked 1,2,4-oxadiazole elastomers is described. The technique involves thermally condensing (1) a monomer having the formula H2N(HON)C-R-Q, wherein Q is a triazine ring-forming groups such as nitrile or amidine or a mixture of such group with amidoxime, or (2) a mixture of the same monomer with R(C(NOH)NH2)2, with R in these formulas standing for a bivalent organic radical. In the monomer charge, the overall proportions of amidoxime groups to triazine ring-forming groups varies depending on the extent of crosslinking desired in the final polymer.

Official Gazette of the U.S. Patent and Trademark Office

N81-24257* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

IN-SITU CROSS LINKING OF POLYVINYL ALCOHOL Patent

Warren H. Philipp, L-Chen Hsu, and Dean W. Sheibley, inventors (to NASA) Issued 14 Apr. 1981 4 p Filed 18 Jan. 1980 Continuation of abandoned US Patent Appl. SN971475, filed 20 Dec. 1978
(NASA-Case-LEW-13135-2; US-Patent-4,262,067; US-Patent-Appl-SN-113014; US-Patent-Class-429-139; US-Patent-Class-429-27; US-Patent-Class-429-28; US-Patent-Class-429-249; US-Patent-Class-429-253; US-Patent-Class-264-104; US-Patent-Class-264-105; US-Patent-Class-525-61; US-Patent-Appl-SN-971475) Avail: US Patent and Trademark Office CSCL 07C

A method of producing a crosslinked polyvinyl alcohol structure, such as a battery separator membrane or electrode envelope is described. An aqueous solution of a film-forming polyvinyl alcohol is admixed with an aldehyde crosslinking agent a basic pH to inhibit crosslinking. The crosslinking agent, perferably a dialdehyde such as glutaraldehyde, is used in an amount of from about 1/2 to about 20% of the theoretical amount required to crosslink all of the hydroxyl groups of the polymer. The aqueous admixture is formed into a desired physical shape, such as by casting a sheet of the solution. The sheet is then dried to form a self-supporting film. Crosslinking is then effected by immersing the film in aqueous acid solution. The resultant product has excellent properties for use as a battery separator.

Official Gazette of the U.S. Patent and Trademark Office

N81-24258* National Aeronautics and Space Administration. Pasadena Office, Calif.

POLYMERIC COMPOSITIONS AND THEIR METHOD OF MANUFACTURE Patent

Billy G. Moser (JPL) and Robert F. Landel, inventors (to NASA) (JPL) Issued 21 Mar. 1972 6 p Filed 22 Dec. 1967 Sponsored by NASA
(NASA-Case-NPO-10424-1; US-Patent-3,651,008; US-Patent-Appl-SN-692636; US-Patent-Class-260-37) Avail: US Patent and Trademark Office CSCL 07C

Filled polymer compositions are made by dissolving the polymer binder in a suitable sublimable solvent, mixing the filler material with the polymer and its solvent, freezing the resultant mixture, and subliming the frozen solvent from the mixture from which it is then removed. The remaining composition is suitable for conventional processing such as compression molding or extruding. A particular feature of the method of manufacture is pouring the mixed solution slowly in a continuous stream into a cryogenic bath wherein frozen particles of the mixture result. The frozen individual particles are then subjected to the sublimation.

Official Gazette of the U.S. Patent and Trademark Office

N81-24259 Rensselaer Polytechnic Inst., Troy, N. Y.

SODIUM DIFFUSION IN LOW ALKALI GLASSES Ph.D. Thesis

John Edward Kelly, III 1980 148 p
Avail: Univ. Microfilms Order No. 8109314

The Na(22) diffusion coefficient was measured in a series of low alkali glasses: SiO2, Na2O-GeO2, Na3O-B2O3, SiO2 and ZnO-B2O3-SiO2. The problem of a high concentration of tracer isotope remaining on the glass surface is attributed to isotope OH interactions on the glass surface. A procedure is presented for obtaining reliable values of the tracer diffusion coefficient when this problem occurs. Dissert. Abstr.

N81-24260 Minnesota Univ., Minneapolis.

MOLD FILLING AND CURING STUDIES FOR THE POLYURETHANE RIM PROCESS Ph.D. Thesis

Jose Mario Castro 1980 269 p
Avail: Univ. Microfilms Order No. 8109399

A complete model of the process is presented. It predicts the pressure rise during filling, the extent of reaction, and temperatures during filling and curing for a rectangular thin mold with an end gate. The model is general enough to include both mixing activated and thermally activated RIM processes. The model was experimentally tested using a polyurethane RIM chemical system, which is mixing activated. The relevant dimensionless parameters for the process are defined. The filling stage is classified according to the values of these parameters. The conditions at which premature gelling or knit lines can become a problem are identified. A method to obtain the kinetic parameters and the viscosity rise, which are needed to model the process, is given. Dissert. Abstr.

N81-24261 Lehigh Univ., Bethlehem, Pa.

INTERFACIAL PHENOMENA OCCURRING IN DRYING SURFACTANT DROPLETS AND POLYMER LATEX FILMS Ph.D. Thesis

Daniel Paul Durbin 1981 348 p
Avail: Univ. Microfilms Order No. 8108193

The driving forces responsible for two interfacial phenomena were identified in this study. The hydrodynamic circulation was observed in evaporating surfactant droplets and the segregation of small diameter polymer latex particles to the interface of films dried from mixtures of large and small diameter latex particles. Surface tension gradients radially extending across sessile surfactant droplet interface were found to induce the hydrodynamic circulation within evaporating surfactant droplets. These surface tension gradients are a result of the concentration dependence of surface tension, geometry of the droplet, and the evaporation process. Dissert. Abstr.

N81-24262 Alfred Univ., N.Y.

STRUCTURES, SPECTRA AND RELATED PROPERTIES OF TUNGSTEN PHOSPHATE GLASSES AND CRYSTALS Ph.D. Thesis

Cheol Young Kim 1981 147 p
Avail: Univ. Microfilms Order No. 8109827

The structure of crystalline W2O3(PO4)2 and tungsten phosphate glasses were analyzed using X-ray powder diffraction, infrared, and Raman spectral techniques. Several physical properties were measured for tungsten phosphate glasses and related to the resulting structural interpretation. The similarities in the envelopes of infrared spectra for crystalline W2O3(PO4)2 and the glass with a similar composition indicated that remnants of the crystalline structure were retained even in the vitreous state. Terminal W-O bonds were found in all glasses as well as in the crystalline phase. The maxima or minima for the thermal expansion coefficients, the softening points and molar volumes occurred for the glass containing 67.7 mole % WO3, and were discussed in terms of glass structure. Increase in the line width of the softening point on the thermal expansion curve indicated that the degree of polymerization increased with P2O5.

Dissert. Abstr.

N81-24263 Alfred Univ., N.Y.

THE EFFECTS OF POWDER PROCESSING ON SINTERING

BEHAVIOR AND MICROSTRUCTURE DEVELOPMENT IN YTTRIA STABILIZED ZIRCONIA Ph.D. Thesis
Curtis Edward Scott 1977 150 p
Avail: Univ. Microfilms Order No. 8108954

Submicron zirconia powders stabilized with 8 wt% and 112 wt% yttria were extensively characterized. A special laundering technique was developed for eliminating up to 95% of chlorine impurity. Chlorine laundering kinetics, determined using specific ion electrodes, indicate that essentially all chlorine was surface adsorbed. The size and concentration of agglomerates and aggregates was reduced by milling and centrifuging. The sintering behavior of compacts of as-received, laundered, milled, and laundered, milled and deaggregated powders was explored using a dilatometer. Comparative sintering behavior for constant rates of heating indicated that the removal of chlorine significantly reduced temperatures for the onset of shrinkage and effective activation energy for initial and intermediate stages of sintering. Removal of agglomerates from powders enabled sintering to final density at lower temperatures. Dissert. Abstr.

N81-24264 Delaware Univ., Newark.
MICROSTRUCTURE AND MECHANICAL PROPERTIES OF ORIENTED POLY(ETHYLENE TEREPHTHALATE FIBERS) Ph.D. Thesis
Kiran Manohar Gupte 1981 215 p refs
Avail: Univ. Microfilms Order No. 8109620

Amorphous Poly(ethylene terephthalate) (PET) fibers of varying initial orientation of polymer chains were annealed in a hot oil bath at four different temperatures with annealing time ranging from 60 milliseconds to one hour. The initial orientation was characterized by the birefringence. Three kinds of fibers with initial birefringence of 0.021, 0.043, and 0.058 were used. The annealed fibers were characterized using X-ray diffractometry and density measurements. Mechanical properties of the fibers were also tested. The mechanical properties revealed an increase in the elastic modulus and the fracture stress with orientation, while the plastic strain and crystallinity. A qualitative explanation of the observed mechanical properties is given. Dissert. Abstr.

N81-24265*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL BARRIER COATING SYSTEM HAVING IMPROVED ADHESION Patent Application
R. C. Bill and J. S. Sovey, inventors (to NASA) Filed 28 Jan. 1981 7 p
(NASA-Case-LEW-13359-1; US-Patent-Appl-SN-229233) Avail: NTIS HC A02/MF A01 CSCL 11A

A metallic bond coat on a substrate is primer coated by depositing an ion sputtered ceramic film. A ceramic thermal barrier coating is then plasma-sprayed onto this primer film. The sputter deposited primer coating improves the integrity and strength of the interface between the plasma-sprayed ceramic layer and metallic bond coat. Improvement of the integrity of the interface insures stronger adherence between the metal and the ceramic. NASA

N81-24266# Texas A&M Univ., College Station. Dept. of Chemical Engineering.
POLYMER/SOLVENT AND POLYMER/POLYMER INTERACTION STUDIES Final Report, Jun. 1979 - May 1980
James C. Holste, Charles J. Glover, Kailash C. B. Dangayach, Ted A. Powell, and Denise T. Magnuson Wright-Patterson AFB, Ohio AFWAL Sep. 1980 139 p refs
(Contract F33615-78-C-5078; AF Proj. 2414)
(AD-A097929; AFWAL-TR-80-4138) Avail: NTIS HC A07/MF A01 CSCL 11/9

The technique of gas chromatography has been used to investigate the solution properties of many solvents with a propargyl (acetylene-terminated) sulfone (PATS). In this case, unlike previous work on the RADEL polysulfone, no correlation between the strength of the specific interaction parameter and the solubility as determined from beaker tests is found. Furthermore, curing of the PATS at 240 C for 24 hours did not change the measured plasticizer/solvent interactions. Piezoelectric sorption techniques were used to study the solution properties of a P1700/ATS/dichloromethane system. Phase equilibrium data are presented for ATS/dichloromethane, P1700/dichloromethane and P1700/ATS/dichloromethane. The ternary system contained 70% P1700 and 30% ATS by weight on a dry basis. Both the Flory-Huggins and corresponding states solutions were used in the data analysis. In both cases, the binary interaction parameter for P1700-ATS interactions indicated strong interactions, in agreement with experimental observations that these polymers form a compatible system. Gas chromatographic investigations of the Radel polysulfone indicate the presence of a phase transition of undertermined character between 185 and 200 C in addition to the glass transition between 220 and 230 C. GRA

N81-24267# Colorado State Univ., Fort Collins. Dept. of Materials Science and Engineering.
FRONTIERS OF GLASS Final Report
J. D. Mackenzie Jan. 1981 23 p Presented at the Sci. Res. Conf., Los Angeles, 16-18 Jul. 1980
(Grant AF-AFOSR-0206-80; AF Proj. 2303)
(AD-A098062; AFOSR-81-0350TR) Avail: NTIS HC A02/MF A01 CSCL 11/2

In the past five years, glasses have become more important as materials of engineering. Some examples are the use of high purity glass fibers in wave-guides, new glass systems for various components of high power lasers, chemically strengthened glass for transparent enclosures and infrared transmitting glasses. A great deal of the research is being done abroad. Most of the research results are of importance to the U.S. Air Force and to U.S. scientists. It was considered highly desirable to organize a scientific conference at which leading foreign scientists who are working on some selected areas of glass science of particular importance be given an opportunity to discuss their most recent research on glass science but it will be important to U.S. glass scientists as well as Air Force personnel. The 12th International Glass Congress was held in Albuquerque, New Mexico from July 6 to 12, 1980. This was a large conference at which hundreds of papers were given by many foreign and U.S. participants. The topics covered ranged from the physics of a glass to glass manufacturing problems faced by industry. Presentations were in English, French and German with simultaneous translations. This did not permit effective discussions. Participants also had to submit a finished manuscript prior to December 31, 1979. Thus it was not a conference at which a selected small group of scientists could discuss their most recent research efficiently. The International Glass Congress, however, did provide the opportunity for some foreign scientists to visit the U.S.A. GRA

N81-24268# Michigan Univ., Ann Arbor. Dept. of Materials and Metallurgical Engineering.
PROCESS DEVELOPMENT FOR SILICON CARBIDE BASED STRUCTURAL CERAMICS Interim Report, 1 Jun. - 31 Dec. 1980
Edward E. Hucke 31 Dec. 1980 44 p refs
(Contract DAAG46-80-C-0056; ARPA Order 3906)
(AD-A098158; AMMRC-TR-81-13) Avail: NTIS HC A03/MF A01 CSCL 11/2

A program is underway to develop a process for making shaped silicon carbide base structural ceramics with reduced microstructural flaw size by in situ reaction of silicon with fine, ultra-uniform pored carbon skeletons that are produced from liquid polymer solutions without particulate additions. Thus far, very uniform carbon skeletons in two pore sizes (2.5 and 0.27 microns) have been produced and siliconized. Very uniform samples of approx 1 cm cross section have been produced in a silicon carbide material of approx 5 microns average size. Limited regions of material with carbide size less than 1 micron have also been produced. Author (GRA)

N81-24269# SRI International Corp., Menlo Park, Calif.
PARTICLE IMPACT DAMAGE IN CERAMICS, PART 4 Annual Report, 8 Feb. 1979 - 7 Feb. 1980
D. A. Shockey, R. L. Burback, D. R. Curran, K. C. Dao, D. C. Erlich, and L. Seaman Mar. 1981 52 p refs
(Contract N00014-76-C-0657)
(AD-A097982) Avail: NTIS HC A04/MF A01 CSCL 11/2

Impacts of tungsten carbide spheres on Si3N4 produced elastic fracture behavior (ring and cone cracks) at room temperature, but elastic-plastic fracture behavior (plastic impressions and radial cracks) at 1400 C. In contrast, no change in fracture pattern at the two temperatures was produced by

impact with steel spheres. These results may be explained by the relative abilities of the impacting spheres to cause plastic flow at the impact site and hence to alter the stress distribution in the Si3N4 specimens. The type and extent of damage produced by hard particle impact at 1400 C appears to be more deleterious to structural integrity than that produced at 20 C under equivalent particle impact loading conditions. When impacted by 1.2 mm diameter tungsten carbide spheres at velocities to 200 m/s, oxidized Si3N4-20 vol% ZrO2 exhibited decidedly less fracture damage than unoxidized material. The impact velocity necessary to initiate ring and radial cracks was significantly higher for oxidized materials, and the rate at which fracture damage, once nucleated, developed was substantially lower. This enhanced dynamic performance is consistent with the enhanced quasi-static properties reported by Lange and may involve oxidation-induced compressive surface stresses, oxidation-induced softening, or both. Progress is reported in the development of a predictive capability for fracture damage produced by particle impact. GRA

N81-24270# Army Materials and Mechanics Research Center, Watertown, Mass. Polymer Research Div.

PYROLYSIS-GAS CHROMATOGRAPHY-MASS SPECTROSCOPY ANALYSIS OF AE 502 RUBBER FUEL HOSES Final Report

Alfred J. Deome and Gary L. Hagnauer Mar. 1981 14 p refs (DA Proj. 1L1-61102-AH-42)
(AD-A097828; AMMRC-TR-81-12) Avail: NTIS HC A02/MF A01 CSCL 07/4

A simplified method of determining rubber elastomer formulations is described. Pyrolysis-gas chromatography-mass spectroscopy was employed as a primary analytical technique to determine monomeric species of the basic elastomer. Supercritical fluid (CO2) extraction followed by gas chromatography-mass spectroscopy was used to extract and characterize plasticizers, antiozonants, antioxidants, and other additives used in the rubber recipe. GRA

N81-24271# ARO, Inc., Arnold Air Force Station, Tenn.

THERMAL RESPONSE AND REUSABILITY TESTING OF ADVANCED FLEXIBLE REUSABLE SURFACE INSULATION AND CERAMIC RSI SAMPLES AT SURFACE TEMPERATURES TO 1,200 F Final Report

E. C. Knox AEDC, Arnold AFS, Tenn. Apr. 1981 50 p refs (AD-A097711; AEDC-TR-79-62) Avail: NTIS HC A04/MF A01 CSCL 11/2

Ten-minute exposure tests were performed on samples of an advanced flexible reusable surface insulation (AFRSI) made of a quartz glass fabric and samples of a ceramic tile reusable surface insulation (RSI). The samples were tested in a wind tunnel aerothermal environment that caused the sample surface to heat to 1,200 F during each exposure. No serious defects in the samples were detected as a result of the exposure. The test technique used provided a suitable aerodynamic heating environment for candidate materials evaluation. GRA

N81-24272# Materials Research Labs., Ascot Vale (Australia).

RECRYSTALLISED RDX FOR RDX/POLYETHYLENE WAX COMPOSITIONS

William S. Wilson May 1980 27 p refs
(AD-A098299; MRL-TN-436) Avail: NTIS HC A03/MF A01 CSCL 19/1

The impact and shock sensitivities of RDX/polyethylene wax compositions prepared from RDX Grade A Class 1 (recrystallized from cyclohexanone) have been measured using the Rotter Impact Test and Gap Test respectively, and the results have been compared with those obtained for compositions prepared from RDX Grade B Class 1 (milled and boiled). The increased impact sensitivity and decreased shock sensitivity of the compositions based on the recrystallised RDX are attributed to the presence of occluted cyclohexanone and the increased particle size.
Author (GRA)

N81-24273# Massachusetts Univ., Amherst. Dept. of Chemistry.

SYNTHESIS AND CHARACTERIZATION OF HIGH ENERGY POLYMERS Final Report, 1 Mar. 1980 - 31 Mar. 1981

James C. W. Chien and C. Peter Lillya 31 Mar. 1981 21 p refs
(Contract N00014-79-C-0265)
(AD-A098228; SCHEP-F1-81) Avail: NTIS HC A02/MF A01 CSCL 11/9

Synthetic methods for introduction of the pendant high-energy groups nitro and azido into olefinic polymers have been devised. Nitromercuration, base-promoted demercuration and reductive removal of residual mercury yields olefinic polymers with a nitro content of up to 15-20% of theoretical. Azidoiodination followed by dehydroiodination produces azidized olefinic polymers with an azide content of up to 60% of theoretical. Substrates have been poly(cis-1,4-butadiene), CTBN, and HTPB. GRA

N81-24274# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.

ELECTRONIC CERAMICS IN HIGH TEMPERATURE ENVIRONMENTS

Alan W. Searcy and David J. Meschi Nov. 1980 17 p refs Presented at the 33d ACS Pacific Coast Meeting, San Francisco, 28 Oct. 1980
(Contract W-7405-eng-48)
(LBL-11821; CONF-801034-8) Avail: NTIS HC A02/MF A01

Simple thermodynamic means are described for understanding and predicting the influence of temperature changes in various environments on electronic properties of ceramics. Thermal gradients, thermal cycling and vacuum annealing as well as the variations of activities and solubilities with temperature, are discussed. DOE

N81-24275# Institut fuer Angewandte Materialforschung der Fraunhoffer-Gesellschaft e. V., Bremen (West Germany).

METALLIC GLASSES [METALLISCHE GLAESER]

W. Vincent Bonn Bundesministerium der Verteidigung 1980 131 p refs In GERMAN; ENGLISH summary
(BMVG-FBWT-80-9) Avail: NTIS HC A07/MF A01

The literature, concerning metallic glasses and their possible applications, was studied. Manufacturing techniques, structural properties, thermal stability, criteria for glass formation, physical and mechanical characteristics as well as methods for development and industrial potential are among subjects covered. Soft or hard magnetic properties combined with extreme hardness are of particular interest, as it their very high tensile strength. At temperatures well below the crystallization temperature fracture during tensile testing is preceded by very little macroscopic deformation. Metallic glasses also have high flexibility and high deformation under compressive stress. Because of chemical homogeneity and the lack of grain boundaries metallic glasses are often more resistant to corrosion than stainless steel. Electronics and electrotechnical areas are the main field of potential applications. Their use as wear resistant materials and in the manufacture of high pressure tubes are envisaged.
Author (ESA)

N81-24276# Centre Technique des Industries Mecaniques, Senlis (France).

ATMOSPHERIC CORROSION Final Report [CORROSION ATMOSPHERIQUE]

C. Fuvelle and M. A. Laroche Oct. 1980 28 p In FRENCH
(CETIM-12-C-011) Avail: NTIS HC A03/MF A01

Natural aging of test panels protected by coatings of different organic paints was undertaken. Two identical series were exposed: one in a rural setting, the other in an industrial area. Temperature and precipitation were not controlled. Three paint types were studied: (1) a glycerol compound lacquer; (2) a polyester paint; and (3) an epoxypolyester paint. Various thickness coatings were applied, and rusting of the test panels was measured. Results show little difference between polyester and epoxypolyester samples. For thin coats, the lacquer provides better protection. Author (ESA)

N81-24277# Bureau of Mines, Tuscaloosa, Ala.

A LABORATORY TEST TO EVALUATE THE RESISTANCE OF REFRACTORIES TO MOLTEN SLAGS Report of Investigations, 1980

J. R. Cobble and L. Y. Sadler, III 1980 19 p refs
(PB81-150179; BM-RI-8468) Avail: NTIS HC A02/MF A01 CSCL 11B

Research was conducted to develop a reproducible laboratory

test for evaluating the resistance of refractories to molten slags. Tests were conducted with a slag representative of slag used to produce mineral wool. A rotating cylindrical furnace was lined with the brick being tested, and it was operated at temperatures up to 1,660 C for periods ranging from 8 to 32 hours. The effects of such variables as slag temperature, rotational velocity, charge rate, and contact time on refractory erosion were determined. The research demonstrated the reproducibility of the test procedure developed. GRA

N81-24278# Bureau of Mines, Tuscaloosa, Ala. Tuscaloosa Research Center.
EFFECT OF ADDITIVES ON SINTERING OF SILICON NITRIDE-ALUMINA COMPOSITIONS
B. W. Jong 1980 22 p refs
(PB81-150120; BM-RI-8466; LC-80-607027) Avail: NTIS HC A02/MF A01 CSCL 11B

The effect of additives on sintering and strength properties of sialon compositions fabricated by a conventional powder metallurgy technique were evaluated. Additions of Y2O3, Gd2O3, CeO2, MgO, ZrO2, ZrSiO4, and MgAl2O4 to a sialon composition containing 70% beta-Si3N4 + 30% alpha-Al2O3 increased sintered densities by as much as 50% over densities of undoped material. GRA

N81-24279# Texas Technological Univ., Lubbock. Inst. for Disaster Research.
A FAILURE PREDICTION MODEL FOR WINDOW GLASS Ph.D. Thesis
William Lynn Beason May 1980 229 p refs
(Grant NSF PFR-77-24063)
(PB81-148421; NSF/RA-800231) Avail: NTIS HC A11/MF A01 CSCL 11B

An analytical method is presented to predict the strength of window glass plates subjected to lateral loads. The model relates the probability of glass plate failure to fundamental glass plate surface properties. It incorporates the following: (1) an analytical representation of the variation of glass strength with different environmental factors; (2) a geometrically nonlinear plate analysis; and (3) a statistical representation of glass plate surface flow properties. The model is formulated so that surface flow properties are dependent only upon the type and treatment of the glass, and are independent of factors such as plate aspect ration, plate glass surface area, and load duration. Validity of the nonlinear plate analysis, incorporated in the model, was demonstrated by comparison of actual and theoretically derived glass plate stresses and deflections. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N81-24280* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
CELL AND METHOD FOR ELECTROLYSIS OF WATER AND ANODE Patent
John R. Aylward, inventor (to NASA) (Hamilton Standard, Windsor Locks, Conn.) Issued 21 Apr. 1981 10 p Filed 20 Jun. 1980 Supersedes N80-26406 (18 - 17, p 2239) Sponsored by NASA
(NASA-Case-MSC-16394-1; US-Patent-4,263,112; US-Patent-Appl-SN-161255; US-Patent-Class-204-129; US-Patent-Class-204-290R; US-Patent-Class-204-290F; US-Patent-Class-204-291; US-Patent-Class-204-252; US-Patent-Class-204-266) Avail: US Patent and Trademark Office CSCL 21D

An electrolytic cell for converting water vapor to oxygen and hydrogen include an anode comprising a foraminous conductive metal substrate with a 65-85 weight percent iridium oxide coating and 15-35 weight percent of a high temperature resin binder. A matrix member contains an electrolyte to which a cathode substantially inert. The foraminous metal member is most desirably expanded tantalum mesh, and the cell desirably includes reservoir elements of porous sintered metal in contact with the anode to receive and discharge electrolyte to the matrix member as required. Upon entry of a water vapor containing airstream into contact with the outer surface of the anode and thence into contact with iridium oxide coating, the water vapor is electrolytically converted to hydrogen ions and oxygen with the hydrogen ions migrating through the matrix to the cathode and the oxygen gas produced at the anode to enrich the air stream passing by the anode.

Official Gazette of the U.S. Patent and Trademark Office

N81-24281 Minnesota Univ., Minneapolis.
ANAEROBIC DIGESTION OF ORGANIC RESIDUES FOR METHANE PRODUCTION: A BIO-KINETIC APPROACH Ph.D. Thesis
Chung Ki Yee 1980 189 p
Avail: Univ. Microfilms Order No. 8109533

A mathematical model was developed describing the anaerobic digestion of cellulosic fibers by two bacterial populations, the acid formers and the methane formers in a series of biochemical reactions. In the first reaction, the polymeric material was hydrolyzed by extracellular enzymes secreted by the acid formers to yield soluble organics which were subsequently metabolized to form volatile fatty acids. In the second reaction, the volatile acids were converted to carbon dioxide and methane by the methanogenic bacteria. This investigation focused on the biokinetics of the former reaction, the hydrolysis-acidification reaction and verification of the model with experimental data. Dissert. Abstr.

N81-24282 Illinois Univ. at Urbana-Champaign.
THEORETICAL STUDIES IN TWO-PHASE FLOW PRIOR TO THE TRANSITION TO DETONATION IN GRANULAR SOLID PROPELLANTS Ph.D. Thesis
Sadanad Sadashiv Gokhale 1980 162 p
Avail: Univ. Microfilms Order No. 8108521

A model describing reactive two phase flow through a gas solid mixture is presented based upon either the concept of continuum mixture or the concept of separated flow continuum. The resulting governing equations are solved by the method of finite differences. Details of two distinct numerical methods to solve these nonlinear, coupled hyperbolic partial differential equations simultaneously are presented. In addition, artificial smearing techniques which are generally needed for the shock capturing methods are investigated. Dissert. Abstr.

N81-24283*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF HYDROPROCESSING SEVERITY ON CHARACTERISTICS OF JET FUEL FROM OSCO 2 AND PARAHO DISTILLATES
George M. Prok, Francisco J. Flores, and Gary T. Seng Jun. 1981 20 p refs
(NASA-TP-1768; E-617) Avail: NTIS HC A02/MF A01 CSCL 21D

Jet A boiling range fuels and broad-property research fuels were produced by hydroprocessing shale oil distillates, and their properties were measured to characterize the fuels. The distillates were the fraction of whole shale oil boiling below 343 C from TOSCO 2 and Paraho syncrudes. The TOSCO 2 was hydroprocessed at medium severity, and the Paraho was hydroprocessed at high, medium, and low severities. Fuels meeting Jet A requirements except for the freezing point were produced from the medium severity TOSCO 2 and the high severity Paraho. Target properties of a broad property research fuel were met by the medium severity TOSCO 2 and the high severity Paraho except for the freezing point and a high hydrogen content. Medium and low severity Paraho jet fuels did not meet thermal stability and freezing point requirements. E.D.K.

N81-24284# Virginia Polytechnic Inst. and State Univ., Blacksburg.
THE 1H AND 13C FOURIER TRANSFORM NMR CHARACTERIZATION OF JET FUELS DERIVED FROM ALTERNATE ENERGY SOURCES Six Month Progress Report, Apr. - Sep. 1980
H. C. Dorn 1980 41 p refs

(AD-A098305) Avail: NTIS HC A03/MF A01 CSCL 20/4

This report discusses LC-superscript 1H NMR studies from semi-preparative to analytical column size in order to establish ultimate chromatographic resolution conditions. It explores quantitative approaches for LC-superscript 1H NMR including a dual effluent stream to allow introduction of a quantitative reference before the superscript 1H NMR detector. It explores quantitative and ultimate sensitivity limits for the present superscript 1H NMR LC detector including optimization of superscript 1H NMR insert for LC-superscript 1H NMR. The report provides LC-superscript 1H NMR data profiles for 10 synthetic mixtures and corresponding analytical data (e.g., total %H, %H, aromatic, %H aliphatic, %n-alkanes and branched alkanes, % alkyl aromatics and substituted naphthalenes). LC-superscript 1H NMR data profiles for 30 middle distillate fuels and corresponding analytical data is provided. This report provides static superscript 1H NMR and superscript 13C NMR quantitative data for 45 middle distillate fuels. At least six of these samples will be diesel fuel marine. It also provides static superscript 1H NMR and superscript 13C NMR quantitative data for 20 synthetic mixtures of hydrocarbons. GRA

N81-24285# Colorado School of Mines, Golden. Research Inst.

PARAMETERS AFFECTING THE CHARACTERISTICS OF OIL SHALE-DERIVED FUELS

Mar. 1981 148 p refs

(Contract DAAK70-80-C-0174)

(AD-A098242) Avail: NTIS HC A07/MF A01 CSCL 20/4

Under the terms of the Defense Production Act, it is expected that as the U.S. oil shale industry develops, the Armed Forces of the United States will be the recipients of significant quantities of fuel products derived from shale oil. Lead responsibility for the preparation of fuel specifications for DF-1, DF-2, and DFA fuels has been charged to the U.S. Army, and in order to prepare realistic specifications for these fuels, the Army must be fully aware of all the parameters that will ultimately affect the characteristics of these fuels. The objective of this research program was to collect, review, and evaluate all pertinent information dealing with the parameters that affect the properties of shale-derived fuels. To varying degrees, the critical parameters were found to be the source of the oil shale, method of retorting, retorting conditions, method and degree of upgrading, and refining techniques employed. With all other factors being equal, each of the above parameters will have an effect on the fuel properties; however, the flexibility inherent in the refining step permits all but the most major variations in shale oil properties to be compensated for in this operation. This report describes all of the parameters that are likely to affect the characteristics of shale-derived fuels, with emphasis on the most significant parameters: retorting and refining. GRA

N81-24286# Wichita State Univ., Kans. Dept. of Chemistry.

MODEL STUDIES OF ENERGETIC COMPOUNDS Final Report, 1 Feb. 1980 - 31 Jan. 1981

W. Robert Carper Mar. 1981 18 p refs

(Grant AF-AFOSR-0104-80; AF Proj. 2303)

(AD-A098142; AFOSR-81-0352TR) Avail: NTIS HC A02/MF A01 CSCL 19/1

Modern weapons are exposed to ever increasing severe environments such as aerodynamic heating and high shock pulses of extended duration in the msec range. Energetic materials capable of surviving this environment and functioning properly must be developed at a reasonable cost. Consequently, research is needed in thermal decomposition kinetics to understand the initiation process. In order to provide necessary shelf-life of energetic materials, we must develop the knowledge to predict the aging process of energetic materials under ambient conditions. This requires research in room temperature kinetics, and how the aging mechanism is affected by binders, etc. The initial objectives of this study included the following: (1) determination of the mode of thermal decomposition of DATB (diaminotrinitrobenzene-DATNB) and TATB (triaminotrinitrobenzene-TATNB), and the identification of the molecular species produced. (2) evaluation of the induction periods and energies of activation associated with the thermal decomposition of DATB and TATB. (3) determination of binder properties of TNB (trinitrobenzene) by studying the DATB-TNB and TATB-TNB molecular complexes by stop-flow and static UV methods. GRA

N81-24287# Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.

MOLTEN SALT COAL GASIFICATION PROCESS DEVELOPMENT UNIT, PHASE 1. VOLUME 2: COMMERCIAL PLANT STUDY Final Report

May 1980 105 p

(Contract DE-AC03-77ET-10296)

(DOE/ET-10296/66-Vol-2) Avail: NTIS HC A06/MF A01

The conceptual design of a grass roots, 500 MW, combined cycle power generating station is presented in which the coal feed is converted to low Btu gas fuel for gas turbines by the molten salt coal gasification process. Based on process flowsheets and major component design parameters, capital and operating cost estimates were prepared. The plant consumes 4600 tons per day of Illinois No. 6 coal and produces 85,500 MM Btu/day of low Btu fuel gas, 98.4% of which is fed to the gas turbines. The gas turbines are designed for 2000 F inlet temperature and are based on United Technology V84 3 machine. The derived economics show that the 500-MW plant can generate electricity at an average selling price of 27.9 mills/kw hr. The calculated overall thermal efficiency is 38.1 (without sulfur credit) at a plant heat rate of 8,958 Btu/Kw hr. The total plant investment is estimated at 318 million dollars while the total capital requirement is estimated at 397 million dollars (all costs based on first quarter 1980 dollars). E.D.K.

N81-24288# Stone and Webster Engineering Corp., N. Y.

NORTHEAST COAL UTILIZATION PROGRAM, PHASE 2 Final Report

Jan. 1981 175 p refs

(EPRI Proj. 1078)

(EPRI-AP-1671) Avail: NTIS HC A08/MF A01

Coal liquefaction by hydrogenation processes is the focus of studies related to technology and economics, to commercial project development, and to plant siting. Achievement of significant coal liquefaction capacity in place is recognized to be hindered by technical risk and lack of economic incentive as the nation adjusts to the use of heavy, high sulfur crude oils. Against this background, the concept is developed of a convertible plant capable of functioning in both coal liquefaction and in heavy oil upgrading. Construction of a single train coal liquefaction facility based on purchasing hydrogen and other services from an adjacent oil refinery is considered as a method of introducing first generation coal liquefaction plants at minimum risk. Coal liquefaction in which distillable, low sulfur liquid products are made appears to be the most economical approach. DOE

N81-24289# California Univ., Livermore.

SYNFUELS FROM FUSION: PRODUCING HYDROGEN WITH THE TANDEM MIRROR REACTOR AND THERMOCHEMICAL CYCLES, VOLUME 1

F. L. Ribe and R. W. Werner 21 Jan. 1981 84 p refs

(Contract W-7405-eng-48)

(UCID-18909-Vol-1) Avail: NTIS HC A05/MF A01

The combination of a fusion reactor driver and a thermochemical plant were examined as a means for producing synthetic fuel in the basic form of hydrogen. The following topics were studied: (1) the tandem mirror reactor, particularly the simple central cell geometry and direct electrical output; (2) a liquid metal cauldron design and a flowing Li2O solid microsphere pellet design comparing the technology, the thermal hydraulics, neutronics, and tritium control in a high temperature operating mode; and (3) three thermochemical cycles, processes in which water is used as a feedback along with a high temperature heat source to produce H2 and O2. DOE

N81-24290# California Univ., Livermore.

SYNFUELS FROM FUSION: PRODUCING HYDROGEN WITH THE TANDEM MIRROR REACTOR AND THERMOCHEMICAL CYCLES

R. W. Werner (Washington Univ., Seattle) 21 Jan. 1981 482 p refs

(Contract W-7405-eng-48)

(UCID-18909-Vol-2) Avail: NTIS HC A21/MF A01

The tandem mirror fusion driver, the cauldron blanket module,

and the flowing microsphere are discussed. Other topics include coupling the reactor to the process, the thermochemical cycles, and chemical reactors and process units. DOE

N81-24291# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.
FLYER SENSITIVITY TEST Interim Report
N. O. Rhoton Jan. 1981 20 p refs Prepared for Sandia Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00487)
(MHSMP-81-09) Avail: NTIS HC A02/MF A01

The development of a flyer sensitivity test to be used for characterization of a variety of explosives having a relatively wide range of sensitivities is reported. Descriptions of the flyer device design and electrical firing source, preliminary results from HNS 1 and HNS 2 threshold tests, flyer planarity data under various conditions of bridge confinement, and velocity calibration data by VISAR measurements are included. DOE

N81-24292# Arizona State Univ., Tempe. Coll. of Engineering and Applied Sciences.
FLUIDIZED BED PYROLYSIS TO GASES CONTAINING OLEFINS
J. L. Kuester 1980 19 p refs Prepared at the Specialists Workshop on Fast Pyrolysis of Biomass, Copper Mountain, Colo., 19-22 Oct. 1980
(Contract DE-AS02-76CS-40202)
(COO-2982-63; CONF-8010126-2) Avail: NTIS HC A02/MF A01

Recent gasification data are presented for a system designed to produce liquid hydrocarbon fuel from various biomass feedstocks. The factors under investigation were feedstock type, fluidizing gas type, residence time, temperature, and catalyst usage. The response was gas phase composition. A fluidized bed system was utilized with a separate regenerator combustor. An olefin content as high as 39 mole % was achieved. Hydrogen/carbon monoxide ratios were easily manipulated via steam addition over a broad range with an autocatalytic effect apparent for most feedstocks. DOE

N81-24293# Pittsburg Univ., Pa. Dept. of Chemistry.
STUDY OF PRECOMBUSTION METHODS OF CHEMICAL COAL CLEANING Final Report
Kenneth D. Jordan 1980 38 p refs
(Contract DE-AO22-79PC-20083)
(DOE/PC-20083/T1) Avail: NTIS HC A03/MF A01

Sixteen of the major processes for chemical coal cleaning were considered. Particular emphasis was placed on the capabilities of each of the processes for the removal of the various types of sulfur commonly found in coal. In many cases information concerning the diffusivity of the reagents and the reactivity of the various organic sulfur functional groups in the coal matrix (before and after treatment) is scarce or lacking. Since the organic sulfur functional groups are tied to the coal and, hence, are relatively immobile, one cannot, in general, fill this void by simple extrapolating from the results obtained using single model compounds which may have very different reactions. The situation is further complicated by the lack of data on the sulfur distribution in a coal before and after treatment in a given process. Usually analysis is conducted only for total sulfur and total organic sulfur. DOE

N81-24294# Iowa State Univ. of Science and Technology, Ames. Dept. of Chemical Engineering.
PHYSICAL AND CHEMICAL COAL CLEANING
T. D. Wheelock and R. Markuszewski 1980 52 p refs Presented at the Conf. on the Chem. and Phys. of Coal Util., Morgantown, W. Va., 2-4 Jun. 1980
(Contract W-7405-eng-82)
(IS-M-287; CONF-8006116-2) Avail: NTIS HC A04/MF A01

Coal is cleaned industrially by freeing the occluded mineral impurities and physically separating the coal and refuse particles on the basis of differences in density, settling characteristics or surface properties. While physical methods are very effective and low in cost when applied to the separation of coarse particles, they are much less effective when applied to the separation of fine particles. Also they cannot be used to remove impurities which are bound chemically to the coal. Most of the chemical cleaning methods under development are designed primarily to remove sulfur from coal but several methods also remove various trace elements and ash-forming minerals. Generally these methods remove most of the sulfur associated with inorganic minerals but only a few of the methods seem to remove organically bound sulfur. A number of the methods employ oxidizing agents such as air, oxygen, chlorine, nitrogen dioxide, or a ferric salt to oxidize the sulfur compounds to soluble sulfate which are then extracted with water. DOE

N81-24295# Los Alamos Scientific Lab., N. Mex.
METHANE HYDRATE GAS PRODUCTION BY THERMAL STIMULATION
Patrick L. McGuire 1981 22 p refs Presented at the 4th Canadian Permafrost Conf., Calgary, Alberta, 2-6 Mar. 1981
(Contract W-7405-eng-36)
(LA-UR-81-645; CONF-810317-1) Avail: NTIS HC A03/MF A01

Two models were developed to bracket the expected gas production from a methane hydrate reservoir. The frontal sweep model represents the upper bound on the gas production, and the fracture flow model represents the lower bound. Parametric studies were made to determine the importance of a number of variables, including porosity, bed thickness, injection temperature, and fracture length. These studies indicate that the hydrate filled porosity should be at least 15% reservoir thickness should be about 25 ft or more, and well spacing should be fairly large (maybe 40 acres/well), if possible. Injection temperatures should be probably be between 150 and 250 F to achieve an acceptable balance between high heat losses and unrealistically high injection rates. Numerous important questions about hydrate gas production remain unanswered. DOE

N81-24296# Oak Ridge National Lab., Tenn. Chemical Technology Div.
HYDROGEN PRODUCTION BY PHOTOSYNTHESIS
Elias Greenbaum 1981 14 p refs Presented at the 5th Ann. IGT Meeting on Energy from Biomass and Wastes, Lake Buena Vista, Fla., 26-30 Jan. 1981
(Contract W-7405-eng-26)
(CONF-810116-1) Avail: NTIS HC A02/MF A01

The photoevolution of hydrogen and oxygen by photosynthesis is an approach to the problem of solar energy conversion. The roles of Photosystem 2 and the electron transport chain of photosynthesis in providing reducing equivalents which are eventually evolved as molecular hydrogen are presented. Experimental data are presented on two systems capable of simultaneous photoproduction of molecular hydrogen and oxygen. The first is a green algal system. The second is a non-living cell-free system comprised of isolated chloroplasts, ferredoxin, and hydrogenase. Both the reduction side of Photosystem 2 as well as endogenous reductants R (interacting directly with the electron transport chain) provide electrons which are evolved as molecular hydrogen. These data suggest that the photochemical machinery of photosynthesis is used to perform true photosynthetic water splitting, i.e., $2H_2O$ yields $2H_2+O_2$. DOE

N81-24297# Imhausen-Chemie G.m.b.H., Lahr (West Germany).
OPTIMIZING THE COMBINATION FISCHER-TROPSCH SYNTHESIS AND GASIFICATION WITH COAL HYDROGENATION FOR THE PRODUCTION OF MOTOR FUELS Final Report
Karl-Heinz Imhausen, Norbert Heger, Karl-Heinz Eisenlohr, Friedrich Schnur, Franz Straetz, Artur Vinke, Hans Gaensslen, Hans Teggers, Uwe Lenz, Dieter Kirchof et al Bonn Bundesministerium fuer Forschung und Technologie Aug. 1980 52 p refs In GERMAN; ENGLISH summary Sponsored by Ministerium fuer Forschung und Technologie Prepared in cooperation with Lurgi Kohle und Mineraloeltechnik G.m.b.H., Frankfurt; Rheinische Braunkohlenwerke A.G., Cologne; Ruhrchemie A.G., Oberhausen, West Germany; Ruhrkohle A.G., Essen; Salzgitter Industriebau G.m.b.H., West Germany; Uhde G.m.b.H., Dortmund, West Germany
(BMFT-FB-T-80-048; ISSN-0340-7608) Avail: NTIS HC A04/MF A01

As part of a follow-on feasibility study of the conversion of coal into liquid motor fuels, the optimum design of a processing plant was considered. The plant capacity is set at 3 million

tons of fuel and liquid gas per year, while brown coal or stone coal are to be used as raw materials. Product output should break down to 45% gasification fuel, 45% diesel oil, and 10% liquid gas. Different solutions for both brown coal and stone coal which meet these specifications are identified, however, their economic feasibility depends on developing markets for gas byproducts in order to reduce production costs.

Author (ESA)

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N81-24298 Illinois Univ. at Urbana-Champaign.
DYNAMIC SOIL-STRUCTURE INTERACTION Ph.D. Thesis
Kuen-Yaw Shye 1980 120 p
Avail: Univ. Microfilms Order No. 8108661

A method is provided for a simple extension of response spectrum procedures in seismic building analysis to include dynamical soil structure interaction. The analysis utilizes soil impedance functions for a structural foundation. Most of the computational results refer to a rigid mat foundation. The damping that arises in a soil structure system is generally nonclassical. A rapid approximate scheme is developed for computing nonclassical modes of a soil structure system. The computation, which is extremely effective, uses a classical mode of the structure with its base fixed. The differences of the initial and improved modes give direct measures of the significance of the interaction effects. The response spectrum approach, is found to be applicable to a soil structure system, including the nonclassical damping that is present. Several examples are presented to demonstrate the capability of the solution method. Dissert. Abstr.

N81-24299 Illinois Univ. at Urbana-Champaign.
MODELING AND ANALYSIS OF CYCLIC BEHAVIOR OF SANDS Ph.D. Thesis
Hassan Mostafa Momen 1980 443 p
Avail: Univ. Microfilms Order No. 8108609

A material model is developed for sands based on the concepts of the theory of plasticity. The model is used in finite element analysis of transient behavior of soil structure under dynamic loading. The model represents the following aspects of behavior: (1) hysteretic energy dissipation; (2) accumulated irreversible deformation; (3) volumetric deformations. The material model presented is a two surface model; a yield surface and a failure surface. The proposed model is capable of representing the important aspects of the behavior of sand. It also proves, via a numerous number of simulations of tests of different stress paths, that the parameters deduced from triaxial test data are valid for other stress conditions. Dissert. Abstr.

N81-24300 Illinois Univ. at Urbana-Champaign.
MECHANISTIC INTERPRETATION OF NONDESTRUCTIVE PAVEMENT TESTING DEFLECTIONS Ph.D. Thesis
Mario Sergio Hoffman 1980 240 p
Avail: Univ. Microfilms Order No. 8108542

A method is proposed for the backcalculation of material properties in flexible pavements based on the interpretation of surface deflection measurements. ILLI-PAVE, a stress dependent finite element pavement model, was used to generate data for developing algorithms and nomographs for deflection basin interpretation. Over 11,000 deflection measurements for 24 different flexible pavement sections were collected and analyzed. Deflections were measured using the Benkelman Beam, the IDOT Road Rater, the Falling Weight Deflectometer, and an accelerometer to measure deflections under moving trucks. Loading mode effects on pavement response were investigated using dynamic and viscous pavement models. The factors controlling the pavement response to different loading modes were explained and identified. Correlations between different devices were developed. The proposed evaluation procedure is illustrated for three different flexible pavements using deflection data collected on several testing dates. Dissert. Abstr.

N81-24301 Washington Univ., Seattle.
SWELL CHARACTERISTICS OF EXPANSIVE SOILS Ph.D. Thesis
Bekele Wolde-Medhin 1980 226 p
Avail: Univ. Microfilms Order No. 8109788

The swelling behavior of sodium montmorillonite based soils (expansive soils) is examined. The soils used for the study were highly plastic with liquid limits ranging between 50 percent to about 230 percent, and according to the Unified Classification System these soils fall in the group of high plastic or fat clays (CH). Swelling or volume change measurements were made under controlled elevated temperatures ranging from room temperature (65 F) to 150 F. Results indicated that the amount of swell (volume change) obtained from the different soil samples was not directly proportional to the abundance of active clay (sodium montmorillonite) present in the soils. However there exists a linear relationship between the amount of active clay present in the soil and the magnitude of volume change. The experimental data were analyzed in terms of temperature, percentage of swell, consistency limits and swelling pressure. Finally, based on the analysis and interpretation of the experimental results, equations for estimating volume change (swell) and swelling pressure are proposed. Dissert. Abstr.

N81-24302*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EMERGENCY RELIEF VENTING OF THE INFRARED TELESCOPE LIQUID HELIUM DEWAR, SECOND EDITION
Eugene W. Urban Apr. 1981 26 p refs Supersedes NASA-TM-78271
(NASA-TM-82420; NASA-TM-78271) Avail: NTIS HC A03/MF A01 CSCL 13L

An updated analysis is made of the emergency relief venting of the liquid helium dewar of the Spacelab 2 Infrared Telescope experiment in the event of a massive failure of the dewar guard vacuum. Such a failure, resulting from a major accident, could cause rapid heating and pressurization of the liquid helium in the dewar and lead to relief venting through the emergency relief system. The heat input from an accident is estimated for various fluid conditions in the dewar and the relief process considered as it takes place through one or both of the emergency relief paths. It was previously assumed that the burst diaphragms in the dewar relief paths would rupture at a pressure of 65 psi differential or 4.4 atmospheres. In fact, it has proved necessary to use burst diaphragms in the dewar which rupture at 115 psid or 7.8 atmospheres. An analysis of this case was carried out and shows that when the high pressure diaphragm rupture occurs, the dewar pressure falls within 8 s to below the 4.4 atmospheres for which the original analysis was performed, and thereafter it remains below that level. S.F.

N81-24303# Washington State Univ., Pullman. Dept. of Mechanical Engineering.
AIR CUSHION LANDING SYSTEM STABILITY STUDY Final Technical Report, 30 Jun. - 19 Sep. 1980
Thomas D. Burton Feb. 1981 65 p refs
(Contract F33615-80-K-3409; AF Proj. 2403)
(AD-A097744; AFWAL-TR-80-3150) Avail: NTIS HC A04/MF A01 CSCL 12/1

An analysis of an inelastic ACLS plunge mode dynamic model is presented. The ACLS has unrestrained side elements and frozen end elements. The model exhibits unstable behavior at certain operating conditions for which the side elements are in contact with the ground. A linear analysis showed this instability to be due mainly to the altitude sensitivities of the cushion to atmosphere airflows and the attendant influence on the dynamic pressure forces on the vehicle. The model instability can be alleviated by isolating side and end elements so that they are all unrestrained and by simultaneously venting the air cushion directly to atmosphere. GRA

N81-24304# Naval Ship Research and Development Center, Bethesda, Md. Ship Performance Dept.
TIP VORTEX CAVITATION CHARACTERISTICS AND DELAY OF INCEPTION ON A THREE DIMENSIONAL HYDROFOIL
William G. Sounders and Gregory P. Platzer Apr. 1981 69 p refs
(SF43421001)

(AD-A098297; DTNSRDC-81/007) Avail: NTIS HC A04/MF A01 CSCL 20/4

A research program was conducted to investigate both the fundamental aspects of, and techniques for delaying, tip vortex cavitation on a three dimensional hydrofoil. The specific concepts considered for delaying tip vortex cavitation included: a bulbous tip, an artificially roughened tip, and a mass injected tip. The experiments were conducted in the David W. Taylor Naval Ship Research and Development Center 24-inch cavitation tunnel, where the effects of the various concepts on both foil tip vortex cavitation inception and performance were established. These measurements were made at a Reynolds number R subscript c, based on root chord length, of approximately 5,000,000. Some of the more fundamental aspects of the tip vortex rollup process have been documented through the use of flow visualization techniques. The results for the tip vortex cavitation delay concepts indicate substantial increases in the tip vortex cavitation inception speed relative to the unaltered tip; i.e., a 94 percent increase for the roughened tip, 38 percent for the bulbous tip, and 54 percent and 33 percent for the active and passive mass injected respectively. These results were obtained over a wide range of foil angle of attack and with little or no measurable loss in foil performance; i.e., no measurable lift decrease or drag increase. Author (GRA)

N81-24305# California Univ., Livermore. Lawrence Livermore Lab.

FIRE PROTECTION RESEARCH FOR ENERGY TECHNOLOGY PROJECTS Report, FY 1979 Year-End

H. K. Hasegawa, N. J. Alvares, A. E. Lipska, H. Ford, and D. G. Beason Jan. 1981 92 p refs

(Contract W-7405-eng-48)

(UCID-18902) Avail: NTIS HC A05/MF A01

Fire protection measures for fusion energy experiments (FEE) are discussed in some detail. Ultimately, it is planned that the detailed study of fusion experiments will provide analytical methodology which can be applied to the full range of energy technology projects. Three major task areas are advanced: (1) determine the fire hazards of current FEE facilities; (2) assess the ability of accepted fire management strategies to meet and negate the hazard; (3) perform research into problem areas to provide input into analytical fire growth and damage assessment models. DOE

N81-24306# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.

POLYMER CONCRETE PIPE FOR HIGH-TEMPERATURE CORROSIVE ENVIRONMENTS

Lawrence E. Kukacka and J. E. Schroeder (Lindsey Industries, Inc., Azusa, Calif.) 1981 15 p refs Presented at the Corrosion/81st Ann. Meeting, Toronto, 6 Apr. 1981

(Contract DE-AC02-76CH-00016)

(BNL-28715; CONF-810402-5) Avail: NTIS HC A02/MF A01

Polymer concrete is a composite material which has strength and durability characteristics superior to those of Portland cement concrete and better durability than steel. Polymer concrete was successfully tested in brine, flashing brine and steam at temperatures up to 260 C. Exposures were as long as 960 days. Glass filament wound polymer concrete pipe was developed with excellent strength, low weight, and a cost comparable to or less than schedule 40 steel. Connections can be made with slip joints for low pressure applications and flanged joints for high pressure applications. DOE

N81-24307# Aluminum Co. of America, Alcoa Center, Pa. Alcoa Technical Center.

PERFORMANCE OF A TECHNICAL AND ECONOMICAL FEASIBILITY STUDY OF AN HVDC COMPRESSED GAS INSULATED TRANSMISSION LINE Quarterly Progress Report, 1 Apr. - 30 Jun. 1980

R. L. LaBarge 1980 157 p refs

(Contract DE-AC01-79ET-29355)

(DOE/ET-29355/T1; QPR-3) Avail: NTIS HC A08/MF A01

HVDC commissioning procedures were successfully demonstrated with model cables. Particles of all types and in large numbers never found in a practical cable are placed in the middle of the model cable at the beginning but are trapped at the end of the commissioning procedure. The concepts of protecting the insulators were successfully realized. Small particles are confined in the lower half of the cable and bounced into traps in the bulge. Large particles invading the top half of the cable are captured hovering around the ends and along the lower edge of the expansion-joint shield. None of the particles can contaminate the insulators. The simulation of the particle path was done with a microcomputer. The very simple simulation model predicts the effect of the enclosure profile and agrees with test observations. Both test observations and the simulations lead to the expectation that a successful HVDC commissioning procedure can be applied to the total length of an installed cable. Overvoltages within the cable due to lightning surges were analzyed. DOE

N81-24308# Societe Nationale Industrielle Aerospatiale, Blagnac (France). Aircraft Div.

COMPUTER AIDED COMPILATION OF AN ELECTRICAL DRAWING FILE

J. P. Pauzat Paris 1980 8 p Presented at ICAS Conf., Munich, 13-17 Oct. 1980

(SNIAS-802-111-110) Avail: NTIS HC A02/MF A01

A computer assisted design system called GICE which manages all the documents in an aircraft wiring drawing file (the Airbus) is described briefly. A set of 40 programs permits the drawing of schematics, wiring diagrams, and routing diagrams, and the reservation of common connectors. The routing diagrams, which are drawn in perspective on the basis of the aircraft structure allow: (1) the loom weight and center of gravity and wire lengths to be determined, (2) the product support department to be provided with a document that can be directly used for the wiring diagram manual, and (3) the exact runs of the looms in the aircraft to be defined, together with their bracketry, for installation on the aircraft. Author (ESA)

N81-24309# Instituto Superiore di Sanita, Rome (Italy). Lab. delle Radiazoni.

THE INTRODUCTION OF THE SIEVERT INTO THE INTERNATIONAL SYSTEM OF UNITS [L'INTRODUZIONE DEL SIEVERT NEL SISTEMA INTERNAZIONALE DELLA UNITA DI MISURA]

P. Salvadori 4 Apr. 1980 15 p refs Submitted for publication

(ISS-P-80/5) Avail: NTIS HC A02/MF A01

The international system of units and its adoption by Italy are discussed, with particular emphasis on the unit for equivalent radiation dose known as the Sievert. The danger of confusion between absorbed dose and equivalent dose measurements is brought up, justifying the adoption of the proposed unit. Author (ESA)

N81-24310# California Univ., Los Angeles. Dept. of Mechanics and Structures.

INTERPRETATION OF STRONG-MOTION EARTHQUAKE RECORDS OBTAINED IN AND/OR NEAR BUILDINGS

Gary C. Hart, Christopher Rojahn, and J. T. P. Yao Apr. 1980 137 p refs Workshop held at San Francisco, 1-2 Apr. 1980

(Grant NSF PFR-79-08980)

(PB81-154726; UCLA-ENG-8015) Avail: NTIS HC A07/MF A01 CSCL 13M

Existing building strong motion earthquake instrumenation programs are reviewed and summarized. Specific aspects discussed include building instrumentation programs, current strong motion ground record processing, utilization of strong motion records in building design, and information obtained from strong motion records. Procedures for processing and interpreting data from existing programs are documented. Methods are identified to improve data acquisition analysis and interpretation techniques. Recommendations address fundamental policy, specific technical aspects of instrumenation, data processing, and research needs. GRA

N81-24311# Transportation Systems Center, Cambridge, Mass.

PIPELINE TRANSPORTATION SAFETY R AND D WORKING GROUP MEETING Interim Report

H. C. Ingrao, R. H. Heidersbach, and R. K. Sharp 30 Jul. 1980 70 p refs Meeting held at Cambridge, Mass., 30 Jun. - 1 Jul. 1980

(PB81-151359; DOT-TSC-RSPA-80-22) Avail: NTIS

HC A04/MF A01 CSCL 13B

A Pipeline Transportation Safety R&D Working Group Meeting took place at the DOT Transportation Systems Center on June 30 - July 1, 1980. The objective of this meeting was to reach concensus on future pipeline transportation safety issues and possible solutions requiring specific and timely R&D. The meeting resulted in the identification of future concerns in the areas of: pipeline system analysis methodology, pipeline inspection and maintenance, and pipeline design and construction. GRA

N81-24312# Louisiana Dept. of Transportation and Development, Baton Rouge. Research and Development Section.

DESIGN AND EVALUATION OF HIGH STRENGTH CONCRETE FOR GIRDERS Final Report, Feb. 1979 - Jun. 1980

Sheldon M. Law and Maasood Rasoulian May 1980 59 p refs

(PB81-151623; RR-138; FHWA/LA-80/138; Rept-138) Avail: NTIS HC A04/MF A01 CSCL 13B

High strength concrete was required for the construction of the new design prestressed girders on the elevated portion of the Westbank Expressway. Laboratory mixing, testing and field evaluation were included. High strength concrete (minimum compressive strength 6500 psi) can be obtained. Both limestone (ASTM no. 7 gradation) and regular Class A concrete produced the necessary strength; however, limestone is considered to be the best material to achieve high strength. GRA

N81-24313# Shanafelt (George O.) and Horn (Willis B.), Olympia, Wash.

DAMAGE EVALUATION AND REPAIR METHODS FOR PRESTRESSED CONCRETE BRIDGE MEMBERS Final Report

George O. Shanafelt and Willis B. Horn Nov. 1980 79 p Sponsored in part by Federal Highway Administration, Washington, D.C. and American Association of State Highway and Transportation Officials, Washington, D.C.

(PB81-156002; TRB/NCHRP/REP-226; ISBN-0-309-03032-3; LC-80-53763) Avail: NTIS HC A05/MF A01 CSCL 13B

The types of accidental damage occurring and the severity and frequency of their occurrence are summarized. Practices and equipment used for assessing damage and making repairs are presented and evaluated. Guidelines for inspection, assessing damage, and selection of repair methods are given. Methods of repair includes adding external prestress, a metal sleeve splice, and splicing broken strands or rods. The findings of this study suggest that in some instances better repair techniques should be used. The findings of this study also indicate that proper selection of repair methods may reduce the number of damaged girders presently being replaced. Plausible methods of repair requiring additional research are identified and techniques for testing are outlined. GRA

N81-24314# Simpson Gumpertz and Heger, Inc., Cambridge, Mass.

PLASTIC PIPE FOR SUBSURFACE DRAINAGE OF TRANSPORTATION FACILITIES Final Report

R. E. Chambers, T. J. McGrath, and F. J. Heger Oct. 1980 163 p refs Sponsored in part by Federal Highway Administration, Washington, D.C. and American Association of State Highway and Transportation Officials, Washington, D.C.

(PB81-156010; TRB/NCHRP/REP-225; ISBN-0-309-03030-7; LC-80-53263; ISSN-0077-5614) Avail: NTIS HC A08/MF A01 CSCL 13B

Buried plastic pipes were considered for the drainage of transportation facilities. Design, installation, and performance criteria were developed, analyzed, and evaluated in order to select pipe systems suitable for the application. Ongoing state installations of plastic pipe were monitored to observe installation practice. Full scale field tests were performed in cooperation with states to obtain realistic data on the effects of installation conditions and on pipe behavior and performance. Several piping systems were deemed appropriate for transportation drainage applications. GRA

N81-24315# Glass and Ceramics International, Inc., Lomita, Calif.

ENERGY CONSERVATION IN THE BUILDING INDUSTRY USING INDUSTRIAL WASTE MATERIALS, PHASE 1 Final Report, 1 Oct. 1979 - 31 Mar. 1980

M. Akbar Ali 1980 60 p refs

(Grant NSF DAR-79-16706)

(PB81-146797; NSF/RA-800311) Avail: NTIS HC A04/MF A01 CSCL 13B

California waste fly ash, pozzolan, and other regional waste materials were investigated with respect to their potential for development as building products. Specific emphasis was placed on the physical, chemical, and mineralogical characterization of the fly ash and waste cement, and processing and characterization of the minerals. Techniques were used involving the fabrication of test samples using a hydraulic press and development of a curing procedure to form a cement bond. Samples were tested using the pozzolanic index and freeze-thaw tests to determine their essential properties including compressive strength, and to identify mineralogical phases (cementatious bonds). Significant results are reported. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N81-24316 Stanford Univ., Calif.

WAVE PROPAGATION IN LAYERED HALF-SPACE Ph.D. Thesis

Mahmood Hemami 1981 243 p

Avail: Univ. Microfilms Order No. 8108944

In recent years there has been a constant stream of research on the dynamics of composite materials and interest has not abated. Approximate and exact methods of analysis have been applied. Exact analysis (applying linear theory of elastics) can be used as a check on approximate analyses of more complicated problems by comparing the solution in special cases. An exact analysis is applied to a composite whose parameters vary only in one direction. Elastic wave propagation in a homogeneous, isotropic, linearly elastic half space and in a periodically layered linearly elastic half space are considered. The equations of elasticity and the Floquet theorem are employed to obtain solutions. Reflection patterns are discussed for both cases and analogies are drawn. Surface waves are given special consideration and Rayleigh wave dispersion in a periodically layered half space is presented. Dissert. Abstr.

N81-24317 Texas Univ. at Arlington.

A STUDY OF RADIATIVE TRANSFER Ph.D. Thesis

Basavaraj Adaviyappa Kagali 1980 186 p

Avail: Univ. Microfilms Order No. 8109190

The fundamentals of a theory of radiative transfer are studied. Unlike the often used phenomenological theory, the new theory is founded on the field equations of electrodynamics incorporating the dual aspects of radiation. It is found to have identical formal structure for both classical and quantum fields. Generalized expressions are derived for the principal quantities of radiative transfer theory such as the specific intensity and the specific flux density and they are shown to reduce to the phenomenological expressions for statistically stationary and homogenous fields. Several typical optical systems are studied in the light of the new formalism wherein reflection, refraction, interference, diffraction, polarization, dispersion, scattering and coherence aspects come into play. It is shown that, in general, one has to deal with groups of extended, smooth, partially polarized and partially coherent rays to understand optical phenomena in the conventional framework. Dissert. Abstr.

N81-24318 Illinois Univ. at Urbana-Champaign.

SCATTERING TECHNIQUES FOR THE GEOPHYSICAL INVERSE PROBLEM Ph.D. Thesis

Fadil Santosa 1980 81 p

Avail: Univ. Microfilms Order No. 8108650

The inverse problem for the propagation of elastic waves in stratified media. The one dimensional inverse problem for the

propagation of shear waves is studied in the context of spectral theory. Certain inverse scattering methods in quantum mechanics are generalized to determine the properties of the stratification from experimental knowledge gathered at the origin of the halfline. This method is applied with some mathematical manipulations to arrive at a procedure to solve the inverse problem for a three dimensional layered half space. This formulation of the problem lead to the complete and unique reconstruction of the depth dependences of the Lame parameters and the density from surface data. A discussion on the applicability of the proposed profile inversion method is given, and it is demonstrated with a numerical example. Dissert. Abstr.

N81-24319 Stanford Univ., Calif.
INFORMATION FLOW IN RELAY NETWORKS Ph.D. Thesis
Mohammad Reza Aref 1981 107 p
Avail: Univ. Microfilms Order No. 8108888

The relay network is a mathematical model for a general single-source single-sink communication network. The network has one input node (source), one output node (sink), an arbitrary number of intermediate nodes (relays), and branches that are noisy communication channels. Based on their past received signals, the relays send information (in a manner to be made clear) to some of the other nodes and the sink. Relay networks in which the output of each branch is a deterministic function of its input are studied and the capacity for such networks are established. The capacity of the relay channel having one deterministic component is also established. The definition of 'degradedness' for relay networks is given and the capacity for this class of relay networks is established. In addition, the capacity of the Gaussian degraded relay network is found. A block Markov encoding scheme is used to prove the achievability of the capacities for 2 relays and the scheme is then generalized for more than 2 relays. Dissert. Abstr.

N81-24320 Mississippi Univ., Jackson.
AN INVESTIGATION OF SLOTTED PARALLEL-PLATE WAVEGUIDES Ph.D. Thesis
Talya L. Keshavamurthy 1980 179 p
Avail: Univ. Microfilms Order No. 8108762

Slotted parallel plate waveguides subject to TEM excitation were investigated. A guide with an infinite, straight slot of uniform width subject to excitation propagating in a direction normal to the slot axis was studied as a guide with an annular slot of uniform width subject to radially propagating excitation. An integral equation was formulated for the slot electric field of a slotted parallel plate waveguide filled inside with a truncated dielectric and the equation was solved numerically by the method of moments. From knowledge of the slot electric field, quantities of interest such as a special aperture admittance, scattering parameters, and radiation pattern were computed. The special aperture admittance which was a useful quantity in the design of the rectangular microstrip antenna was examined for very small plate separation and different truncation lengths of dielectric. The characteristics of a slotted guide with the slot covered by a dielectric hemicylinder on the exterior were also studied. Of particular interest was the radiation pattern of the slot with loading. Dissert. Abstr.

N81-24321*# Old Dominion Univ., Norfolk, Va. Dept. of Electrical Engineering.
AIRBORNE ANTENNA PATTERN CALCULATIONS Progress Report, 1 Nov. 1980 - 30 Apr. 1981
Timothy J. Knerr and Roland R. Mielke May 1981 17 p refs (Grant NsG-1655)
(NASA-CR-164350) Avail: NTIS HC A02/MF A01 CSCL 20N

Progress on the development of modeling software, testing software against caclulated data from program VPAP and measured patterns, and calculating roll plane patterns for general aviation aircraft is reported. Major objectives are the continued development of computer software for aircraft modeling and use of this software and program OSUVOL to calculate principal plane and volumetric radiation patterns. The determination of proper placement of antennas on aircraft to meet the requirements of the Microwave Landing System is discussed. An overview of the performed work, and an example of a roll plane model for the Piper PA-31T Cheyenne aircraft and the resulting calculated roll plane radiation pattern are included. E.A.K.

N81-24322*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THEORETICAL INVESTIGATION OF THE GENERATION AND INJECTION OF ELECTROMAGNETIC WAVES IN SPACE PLASMA BY MEANS OF A LONG-ORBITING TETHER Final Report, 11 Dec. 1979 - 10 Dec. 1980
Marino Dobrowolny (Lab. Plasma Spazio, C.N.R., Frascati, Italy) Feb. 1981 92 p refs
(Contract NAS8-33520)
(NASA-CR-161769) Avail: NTIS HC A05/MF A01 CSCL 20N

Analysis of the various mechanisms of electromagnetic wave generation by the shuttle-borne orbiting tether of the T.S.S. Facility shows that significant electrodynamic power levels are available even when overestimating the loss mechanisms expected to intervene. This electrodynamic power is in part dissipated by Joule losses in the tether, in part goes to accelerate electrons through the sheath surrounding the balloon (when in a downward deployment), and in part goes into e.m. wave generation. A preliminary estimate shows that a 100 km tether in orbit would produce ULF/ELF signals that are detectable on the ground with state-of-the-art magnetometric instrumentation. A.R.H.

N81-24323*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SUBMILLIMETER, MILLIMETER, AND MICROWAVE SPECTRAL LINE CATALOGUE
R. L. Poynter and H. M. Pickett 1 Jun. 1981 151 p refs
(Contract NAS7-100)
(NASA-CR-164357; JPL-Pub-80-23-Rev-1) Avail: NTIS HC A08/MF A01 CSCL 20N

A computer accessible catalogue of submillimeter, millimeter and microwave spectral lines in the frequency range between 0 and 3000 GHZ (i.e., wavelengths longer than 100 mu m) is presented which can be used a planning guide or as an aid in the identification and analysis of observed spectral lines. The information listed for each spectral line includes the frequency and its estimated error, the intensity, lower state energy, and quantum number assignment. The catalogue was constructed by using theoretical least squares fits of published spectral lines to accpeted molecular models. The associated predictions and their estimated errors are based upon the resultant fitted parameters and their covariances. Future versions of this catalogue will add more atoms and molecules and update the present listings (133 species) as new data appear. The catalogue is available as a magnetic tape recorded in card images and as a set of microfiche records. A.R.H.

N81-24324# Research Inst. of National Defence, Stockholm (Sweden).
NOISE AND SIGNAL LEAKAGE IN DOPPLER RADAR MICROWAVE MIXERS [BRUS OCH LAECKSIGNALER I MIKROVAEGSBLANDARE FOER DOPPLERRADAR]
Herbert Steyskal Feb. 1980 53 p refs In SWEDISH
(FOA-C-30181-E1) Avail: NTIS HC A04/MF A01

A functional calculation method which quantitatively expresses the amplitude of intermediate frequency oscillations, associated with the handling of several signals by microwave mixers, is described. The noise characteristics of the local oscillators as well as of the perturbative signals are discussed. Application is shown by calculation examples, covering ordinary and balanced mixers. Oscillation amplitude is parameterized for mixer output, given either a quadratic or a linear detector. Author (ESA)

N81-24325# Lincoln Lab., Mass. Inst. of Tech., Lexington.
NETWORK SPEECH SYSTEMS TECHNOLOGY PROGRAM Annual Report, 1 Oct. 1979 - 30 Sep. 1980
Clifford J. Weinstein 30 Sep. 1980 40 p refs
(Contract F19628-80-C-0002)
(AD-A097998; ESD-TR-80-222) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report documents work performed during FY 1980 on the DCA-sponsored Network Speech Systems Technology Program. The areas of work reported are: (1) communication systems studies in Demand-Assignment Multiple Access (DAMA),

voice/data integration, and adaptive routing, in support of the evolving Defense Communications System (DCS) and Defense Switched Network (DSN); (2) a satellite/terrestrial integration design study including the functional design of voice and data interfaces to interconnect terrestrial and satellite network subsystems; and (3) voice-conferencing efforts dealing with support of the Secure Voice and Graphics Conferencing (SVGC) Test and Evaluation Program. Progress in definition and planning of experiments for the Experimental Integrated Switched Network (EISN) is detailed separately in an FY 80 Experiment Plan Supplement. Author (GRA)

N81-24326# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SAMPLED-DATA RECEIVER DESIGN AND PERFORMANCE FOR BPSK AND MSK SPREADING MODULATIONS
Edward J. Kelly 19 Jan. 1981 53 p
(Contract F19628-80-C-0002)
(AD-A098000; TR-550; ESD-TR-80-240) Avail: NTIS HC A04/MF A01 CSCL 17/2

Certain spread-spectrum systems make use of waveforms built of basic pulses spread by PN modulation of some kind. In this study the two most common modulation waveforms, BPSK and MSK are discussed in detail. The objective is to derive receiver structure utilizing sampled-data integration of the chips, for example, using CCD or digital correlators. A constructive design procedure is described, together with an analysis of performance in terms of SNR loss due to sampling. It is shown that sampling loss can be reduced by proper choice of the prefilter which precedes the sampling of the data. Author (GRA)

N81-24327# Illinois Univ. at Chicago Circle, Chicago. Electromagnetic Imaging Div.
POLARIZATION UTILIZATION IN RADAR TARGET RECONSTRUCTION Interim Report
Wolfgang M. Boerner, Mohamed B. El-Arini, Chung-Yee Chan, Sasan Saatchi, and Wai-Si Ip 15 Jan. 1981 196 p refs
(Contracts N00019-80-C-0620; N00014-80-C-0773; N00014-80-C-0708; DAAG92-80-K-0027)
(AD-A097990; UICC-CL-EMID-NANRAR-81-01) Avail: NTIS HC A09/MF A01 CSCL 17/9

Basic theories for polarization utilization in radar target reconstruction are presented and a general literature review with many pertinent references is given. The mathematical descriptions of polarization in terms of the Poincare polarization sphere are introduced and the relationships existing among the radar scattering matrix (S), the Stokes reflection matrix (M), the modified Mueller matrix (Mm), and the coordinates of the related co-polarization and cross-polarization nulls on the Poincare sphere are derived. It is shown that a scattering phenomenon can be uniquely expressed given the elements of either one of (S), (M), (Mm) or the coordinates of the optimal polarizations, i.e., unique inversion relations among the four equivalent representations exist which is relevant to target polarization synthesis. The developed theories are verified by computer computation using measurement data and/or model scattering data as inputs. The computer programs are listed and examples of our optimal polarization analysis are presented for the monostatic, relative phase case. Single perfectly conducting target shapes and some sea clutter testing models with and without target were chosen; and our studies demonstrate clearly that the optimal polarization concept introduced by KENNAUGH is very useful in radar target analysis as will be further pursued in other forthcoming reports. GRA

N81-24328# Air Force Weapons Lab., Kirtland AFB, N. Mex.
SURFACE FIELD MEASUREMENTS OF SCALE MODELS IN THE TIME DOMAIN Final Report
H. S. Cabayan Feb. 1981 172 p refs
(AF Proj. 1209)
(AD-A098023; AD-E200665; AFWL-TR-78-203) Avail: NTIS HC A08/MF A01 CSCL 20/14

Time-domain measurement have been performed of the surface densities of current and charge induced on scale models when illuminated by a transient electromagnetic pulse in order to provide test points to validate numerical models. three bodies--a cylinder, a crossed-cylinder, and a 1:100 scale model 747 aircraft were used in the experiments. Responses were measured for objects in a simulated free space environment and in the proximity of a perfectly conducting plane. The measured time domain data are fourier transformed to the frequency domain, and analyzed via parameter estimation algorithms to extract the complex natural frequencies of the structures. GRA

N81-24329# Naval Postgraduate School, Monterey, Calif. Dept. of Electrical Engineering.
THE DEVELOPMENT OF A BISTATIC ELECTROMAGNETIC SCATTERING LABORATORY EMPLOYING TIME DOMAIN MEASUREMENT TECHNIQUES FOR IMPULSE RESPONSE DETERMINATION AND TARGET CLASSIFICATION M.S. Thesis
Charles W. Hammond, Jr. Dec. 1980 111 p refs
(AD-A098065) Avail: NTIS HC A06/MF A01 CSCL 17/9

A time domain measurements, electromagnetic scattering laboratory has been developed to provide a means of experimentally measuring the transient, scattered electromagnetic fields from symmetric objects for impulse response determination or target classification. The evolution of the physical laboratory is described in terms of the development of the transmitting and receiving antennas, the interface of the data processing hardware, the signal processing scheme, the software routine functions, and the fabrication of scattering range targets. The smoothed impulse response of a thin wire scatterer is experimentally determined, and a comparison of these measurements is made to a theoretical calculation of the response. GRA

N81-24330# Mark Resources, Inc., Marina Del Rey, Calif.
SIMULATING RADAR SIGNALS FOR DETECTION PERFORMANCE EVALUATION Final Technical Report, 1 Oct. 1978 - 31 Dec. 1980
R. L. Mitchell Griffiss AFB, N. Y. RADC Feb. 1981 113 p refs
(Contract F19628-79-C-0012; AF Proj. 2305)
(AD-A097765; RADC-TR-80-410) Avail: NTIS HC A06/MF A01 CSCL 17/9

A simulation procedure is developed for determining detection performance of a ground-based radar against airborne targets under a wide variety of environment and system conditions. Quadrative video signals are simulated as they are transmitted, reflected from the scattering environment, and processed in the radar receiver. Importance sampling techniques are used to simulate low false alarm rates. GRA

N81-24331# Naval Research Lab., Washington, D. C. Radar Analysis Branch.
RADAR BIAS ERROR REMOVAL ALGORITHM FOR A MULTIPLE-SITE SYSTEM Interim Report
A. Grindlay 13 Apr. 1981 15 p refs
(SF12133401)
(AD-A097769; NRL-R-8467) Avail: NTIS HC A02/MF A01 CSCL 17/9

An algorithm has been developed to estimate the bias errors in the measurements made at two separate radar sites. This was accomplished by considering the measurements made on several common tracks and by using the difference vector between the measurement as the input to a kalman filter to produce smoothed bias errors in range, azimuth, and elevation for each site. For purposes of this study the location of each site was assumed to be known exactly. Author (GRA)

N81-24332# Hughes Aircraft Co., Culver City, Calif. Laser Systems Div.
PULSED RF WAVEGUIDE STUDIES PROGRAM Final Report, Jul. 1978 - Aug. 1980
L. V. Sutter May 1980 70 p refs
(Contract DAABC7-78-C-2450)
(AD-A098164; HAC-FR-80-72-997; DELNV-TR-78-2450-1-2)
Avail: NTIS HC A04/MF A01 CSCL 20/5

The purpose of the Pulsed RF Waveguide Studies Program was to demonstrate the feasibility of and perform parametric studies on flowing and sealed RF pumped CO2 waveguide lasers. This report deals with both the theoretical and experimental aspects of the program including analysis of the data and an outline of the experimental equipment and procedures used to obtain the data. During phase 1 of the program, flowing gas parametric performance studies were performed. The phase 2 work covered aspects of sealed laser operation including parametric gain and power output results with life tests data.

Two laser heads and one power supply were also built and delivered to NVEOL in this phase. The data obtained during this study was excellent and many notable accomplishments were realized. These results are sufficiently promising as to assure the pulsed RF laser a place in many tactical CO2 systems. GRA

N81-24333# Deutsche Bundespost, Darmstadt (West Germany).
AUTOMATIC TRACKING OF GROUND STATION ANTENNAS BY MEANS OF HIGHER ORDER WAVEGUIDE MODES
H. Scheffer Feb. 1980 28 p refs In GERMAN; ENGLISH summary
(FI-454-TBR-33) Avail: NTIS HC A03/MF A01

Utilization of higher order waveguide modes, which are excited in the feed when the satellite is displaced from the boresight axis of the antenna is discussed. The physical relations involved in the excitation of higher order waveguide modes as a function of the antenna position are explained. The starting points of these considerations are the radiation patterns of the tracking modes excited by feeds with circular and square cross sections. Special mention is made of the derivation of the offset information in the cases of circular and linear polarization of the beacon signal. The principle of selective mode coupling by means of tracking mode couplers is described. A compilation of German ground station antennas is given, which apply tracking by higher order waveguide modes. Author (ESA)

N81-24334# Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Munich (West Germany).
TECHNIQUE TO MEASURE SHORT WAVE SOLAR RADIATION WHICH IS STRONGLY INFLUENCED BY CHANGES IN THE OZONE LAYER
F. Bahe, H. Illner, N. Marx, U. Schurath, and P. Roeth Jan. 1979 100 p refs In GERMAN; ENGLISH summary
(BPT-4/79) Avail: NTIS HC A05/MF A01

A technique which measures the rate constant K sub 1D of O (1D) formation by ozone photolysis in sunlight was developed. Ozone in excess N20 was exposed in quartz actinometers, and k sub 1D was calculated from the N2 yield, corrected for ozone decay and optical density. Measurements at ground level in 1977/78 yield k sub 1D values between 0.8 and 16.0 X 10 to the minus 6th power/sec, corroborating the dependence on ozone column density and solar angle predicted by model calculations. Also measured were daylight uv spectra at 0.4 nm resolution which integrate over direct and diffuse solar radiation with especially constant sensitivity. Author (ESA)

N81-24335# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Informatique.
PERFORMANCE OF STANDARDIZED SATELLITE COMMUNICATION PROTOCOLS
Harry Perros (Illinois Univ.) and Guy Pujolle 1980 26 p refs Submitted for publication
(ENST-C-80003) Avail: NTIS HC A03/MF A01

The high-level data link control (HDLC) balanced class of procedures in the asynchronous response mode for satellite links is studied, using analytic models. Both retransmission policies, i.e. reject and selective reject, are considered. The analytic models were validated using simulation data. The results obtained relate maximum effective throughput to bit-error rate, channel capacity, maximum window size, packet length and retransmission policy. It is demonstrated that for high propagation delay the standard HDLC protocol is unsuitable. An improved HDLC protocol based on the idea of virtual subchannels is proposed. Author (ESA)

N81-24336# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
MECHANICAL PARAMETRIC AMPLIFIERS FOR GRAVITATIONAL WAVE DETECTION [AMPLIFICATORI PARAMETRICI MECCANICI PER LA RIVELAZIONE DI ONDE GRAVITAZIONALI]
F. Bordoni Oct. 1980 15 p refs In ITALIAN
(LPS-80-16) Avail: NTIS HC A02/MF A01

The application of a mechanical parametric amplifier which improves the signal to noise ratios in the detection of gravitational waves is analyzed theoretically. The general properties of parametric amplifiers are studied and an equivalent circuit of the proposed device is presented. Calculations characterizing the parametric amplifier are explained. It is shown that the effect of this transducer is equivalent to a reduction in the noise temperature of the electronic amplifier by a factor equal to the power gain of the parametric device. Author (ESA)

N81-24337# Cincinnati Univ., Ohio.
OPTICAL COMMUNICATION SYSTEMS: PROCEEDINGS OF THE NSF GRANTEE-USER MEETING
J. T. Boyd 1980 175 p refs Meeting held at Cincinnati, 3-4 Jun. 1980 Prepared in cooperation with Battelle Columbus Lab.
(Contract NSF ENG-76-17145)
(PB81-147621; NSF/RA-800366) Avail: NTIS HC A08/MF A01 CSCL 17B

State of the art development in optical communication theory and devices were presented in eight technical sessions. Several major topics were covered: quantum and stochastic aspects of optical communications; atmospheric and fiber optical communications; guided wave optical devices; semiconductor lasers and integrated optical device configurations; 3-5 compound devices; and optical devices such as infrared detectors and blue-green laser development for optical communications. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N81-24338* National Aeronautics and Space Administration. Pasadena Office, Calif.
LOW CURRENT LINEARIZATION OF MAGNETIC AMPLIFIER FOR dc TRANSDUCER Patent
Satoshi Nagano, inventor (to NASA) (JPL) Issued 14 Apr. 1981 6 p Filed 22 Jun. 1979 Supersedes N79-26311 (17 - 17, p 2256) Sponsored by NASA
(NASA-Case-NPO-14617-1; US-Patent-4,262,259; US-Patent-Appl-SN-051269; US-Patent-Class-330-8) Avail: US Patent and Trademark Office CSCL 09A

A magnetic amplifier having two saturable reactor cores with a separate excitation winding on each connected in series opposition, a common control winding, and a common output winding, is adapted for use as a low level signal transducer. The separate excitation windings are excited in push-pull mode through a center tapped transformer, and at least one diode is included in series with a load resistor connected to the output winding. A resistor in series with the output winding and load resistor is connected between the center tap of the excitation transformer and the connection between the two excitation windings of the saturable cores. This series resistor provides a return current path for the output winding and allows the excitation windings of the saturable cores to operate as primary windings of transformers.

Official Gazette of the U.S. Patent and Trademark Office

N81-24339 Stanford Univ., Calif.
SHAPE DETERMINATION AND PLACEMENT ALGORITHMS FOR HIERARCHICAL INTEGRATED CIRCUIT LAYOUT Ph.D. Thesis
Eric Alan Slutz 1981 191 p
Avail: Univ. Microfilms Order No. 8108999

Algorithms for the automatic layout of integrated circuits are presented. The algorithms use a hierarchical decomposition of the circuit structure. Since this reduces the complexity of the design, it is an aid to the designer as well as the means of making possible the automated approach to layout. The layout method consists of two phases: a top-down phase during which the shapes of the components at each level are determined, followed by a bottomup phase where a final placement and routing for each level is computed. The data structure used to model the chip surface is central to the algorithms. This data structure is presented along with the alternative structures. Four

basic operations of adding components, deleting components, sizing, and building the structure for a given placement are described. A file format for capturing integrated circuit design information is also described. Dissert. Abstr.

N81-24340 Stanford Univ., Calif.
ELECTRICAL MEASUREMENTS OF PIEZOELECTRIC PARAMETERS OF POLYVINYLIDENE FLUORIDE (PVF2) Ph.D. Thesis
Behruz Rezvani 1981 112 p
Avail: Univ. Microfilms Order No. 8108984

Electromechanical models which are electrical analogs for the PVF2 film are presented, since they are simpler to use and also display both the mechanical and electrical properties of the film. An all electrical measurement method for measurement of the piezoelectric parameters of PVF2 is described and then extended to measure the mechanical parameters of PVF2 completely by electrical means. This measurement technique was used to study the behavior of the parameters of the film under variations of temperature and applied field strength. Carefully controlled conditions were set up and the amount of polarization which occurs during the process was recorded. The new measurement technique was then used to evaluate by electrical means the electromechanical properties of devices made from PVF2. Dissert. Abstr.

N81-24341 California Univ., Santa Barbara.
A VERTICAL FET STRUCTURE FOR MICROWAVE POWER APPLICATIONS Ph.D. Thesis
Pablo Eugenio DAnna 1980 127 p
Avail: Univ. Microfilms Order No. 8108359

The realization of a 1 watt power output, silicon, JFET test structure operating at microwave frequencies (1 GHz.) is presented. The N Channel device uses a self-aligned, ion implanted, vertical design that increases the gate packing density and allows high frequency operation. The self-aligned gate was produced by the use of a plasma dry process. An analytical expression for the current voltage characteristics of the device is obtained. This formulation provides an extension to the well-known Shockley theory for field effect transistors for the analysis of structures with small length to width ratios operating under velocity saturation conditions. A transit time formulation is used to obtain values for c sub gs (the gate source small signal capacitance), that together with values of g sub m (the small signal forward mutual conductance) found from the analysis indicated above permits the determination of the elements of a first order equivalent circuit. Finally, a large signal characterization method is employed to obtain operating power R.F. data for the test structure at 1 GHz. Dissert. Abstr.

N81-24342 Illinois Univ. at Urbana-Champaign.
AN INVESTIGATION OF ORDERING, TEARING, AND LATENCY ALGORITHMS FOR THE TIME DOMAIN SIMULATION OF LARGE CIRCUITS Ph.D. Thesis
Ping Yang 1980 180 p
Avail: Univ. Microfilms Order No. 8108709

Approaches to the simulation of integrated circuits which can alleviate the problems of excessive computation time and high storage requirements were investigated. An ordering scheme for the modified model approach was developed, and some algorithms for the dc and transient analysis of logic circuits were studied. Different tearing methods and sparsity considerations for the node tearing method were theoretically and experimentally studied. Latency at the subcircuit and the network levels was investigated. Different latency criteria were proposed and studied. The result of this research is a new general purpose circuit simulation program SLATE. Dissert. Abstr.

N81-24343 Illinois Univ. at Urbana-Champaign.
THE CONVECTIVE TRANSPORT FROM DROPS IN AN ELECTRIC FIELD Ph.D. Thesis
Stewart Kingsley Griffiths 1980 129 p
Avail: Univ. Microfilms Order No. 8108524

The low Peclet number transport is investigated analytically using a regular and a composite, double perturbation expansion. A digital computer is employed to obtain exact solutions to the recursive governing equations. Effects of neighboring drops are included in the analysis of an alternating electric field and the induced fluid motion. The results obtained, in conjunction with analyses of transport from a single drop, provide effective heat or mass transfer rates. The net rate of transient convective heat transfer from a body at uniform temperature in steady flow is shown to be invariant to pointwise reversal of the flow.
Dissert. Abstr.

N81-24344 Illinois Univ. at Urbana-Champaign.
WAVES IN ANISOTROPIC AND BIREFRINGENT ARTIFICIAL DIELECTRICS Ph.D. Thesis
Michael James OBrien 1980 132 p
Avail: Univ. Microfilms Order No. 8108617

The need for light weight multiple beam communication satellite antenna systems has stimulated renewed interest in artificial dielectrics. The particular dielectric studied is comprised of periodically spaced square arrays of thin square metallic obstacles. The major objectives are: to determine why the lenses previously built with this material failed to perform properly; and to design a functional lens if possible. The wave propagation properties of this type of medium are found using a full wave analysis. An equivalent multiport network models the modal conversion at the obstacle plane. An eigenvalue problem is then formulated to determine an effective index of refraction and wave admittance for the periodic structure. These bulk properties are subsequently used to analyze the propagation of a microwave beam incident on a medium. The refraction of a beam through a simple dielectric slab is considered first because one can include the effects of both the multiple internal reflections and the susceptive discontinuities at the boundary surfaces.
Dissert. Abstr.

N81-24345 California Univ., Santa Barbara.
COMPENSATION FOR NONIDEAL EFFECTS IN SURFACE ACOUSTIC WAVE INTERDIGITAL FILTERS Ph.D. Thesis
Edward Bruce Savage 1980 396 p
Avail: Univ. Microfilms Order No. 8108370

The passband shape, which often is close to the ideal response, and the heights of the sidelobes of the filter response were studied. Various nonideal effects are considered, and procedures are presented to calculate the filter response, including the most important nonideal effects pertinent to the two most common substrate materials for these devices. The effects analyzed include diffraction of surface waves, which results from the finite finger overlap lengths, for ST quartz substrates; and the actual, not idealized, field generation process for YZ lithium niobate substrates. Also considered is the measurement of experimental devices, and interpretation of the measured responses. Finally, ways to change the designed device to get better responses are considered. Emphasis is placed on compensation by changing the basic design parameters, namely, the electrode overlaps and positions. Various methods are presented that will systematically find better designs. Examples of the use of these methods are presented, which utilize the diffraction analysis of ST quartz devices. Dissert. Abstr.

N81-24346 Texas Univ. at Arlington.
A TEST GENERATION AND TEST SET EVALUATION SYSTEM FOR SEQUENTIAL LOGIC NETWORKS Ph.D. Thesis
William Russell Read, Jr. 1980 139 p
Avail: Univ. Microfilms Order No. 8109231

One of the major problems for the integrated circuit industry is testing of the manufactured chip or board. The advent of LSI and VLSI has made this a more difficult problem. Three aspects of this problem were examined. The first is the problem of generating tests to adequately test the circuit. The second aspect is how to determine if the test set generated is really capable of detecting the faults present in the device without performing the costly fault simulation of the entire fault set. The third aspect is to integrate these features with other test generation techniques and an accurate fault simulator into a complete system.
Dissert. Abstr.

N81-24347 Stanford Univ., Calif.
THE PHYSICS AND MODELING OF LATCH-UP AND CMOS INTEGRATED CIRCUITS Ph.D. Thesis
Donald Bruce Estreich 1981 332 p
Avail: Univ. Microfilms Order No. 8108922

The physics, modeling and prevention of latch-up in bulk complementary metal oxide semiconductor (CMOS) integrated circuits are investigated. Latch-up is defined as regenerative switching along a pnpn path and is a commonly encountered failure mode in CMOS integrated circuits. Three latch-up initiation modes are explored: terminal overvoltage; terminal voltage transients; and intense ionizing radiation. The fundamental conditions for latch-up are described. The latch-up threshold requirements are quantified in the form of the minimum current gain product and the holding current. Results quantify the role of the parasitic resistances (both bipolar emitter base shunting and emitter series resistances) of a latch-up path in determining the minimum current gain product and the holding current.
Dissert. Abstr.

N81-24348*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LADDER SUPPORTED RING BAR CIRCUIT Patent Application
H. G. Kosmahl, inventor (to NASA) Filed 3 Apr. 1981 11 p (NASA-Case-LEW-13570-1; US-Patent-Appl-SN-251009) Avail: NTIS HC A02/MF A01 CSCL 09A

An improved slow wave circuit especially useful in backward wave oscillators is comprised of rings disposed between and attached to respective stubs which are themselves attached to opposing sidewalls of the waveguide. To the end that opposed, interacting magnetic fields will be established to provide a very high coupling impedance for the slow wave structure, axially orientated bars are connected between rings in alternate spaces and adjacent to the attachment points of stubs. Similarly, axial bars are connected between rings in the spaces which do not include bars and at points adjacent to the attachments of bars. The rings may be half rings of 180 deg arc and may be formed of flat metal ribbons. NASA

N81-24349# Institute for Defense Analyses, Arlington, Va.
VERY LARGE SCALE INTEGRATED CIRCUITS FOR MILITARY SYSTEMS Final Report
Glenn W. Preston Jan. 1981 93 p refs
(Contract MDA903-79-C-0202)
(AD-A098176; AD-E500300; IDA-P-1538; IDA-HQ-80-22941) Avail: NTIS HC A05/MF A01 CSCL 09/5

The integrated circuit (IC) technology which is to be developed under the ongoing Very-High-Speed Integrated Circuits (VHSIC) program will provide the IC physical characteristics which are necessary for important performance improvements and cost avoidance in many military systems. However, the full realization of the potential benefits of this technology demands new computer architectural concepts based upon new IC functional designs. For the more demanding applications the abandonment of the classical 'Von Neumann' computer organization (in which instructions and data are stored in the memory, fetched, and processed sequentially) is indicated in favor of processor organizations which permit high degrees of concurrency (parallelism and pipelining), local data storage, reconfigurable data paths (in order to minimize the number of memory fetches), etc. Data processors of this form will require new switching circuits and hardware macros (which perform specialized complex operations). This report reviews some of the available design options for circuits of this type. GRA

N81-24350# National Physical Research Lab., Pretoria (South Africa).
A DIGITAL INTEGRATOR
J. Harris Jul. 1980 29 p
(CSIR-SR-FIS-213; ISBN-0-7988-1935-9) Avail: NTIS HC A03/MF A01

A digital integrator designed for use on a spark-source mass spectrometer but adaptable for any application where charge, low current, or low voltage need to be quantified, is described. The integrator incorporates a digital display and a semiconductor operational amplifier capable of measuring ion currents having a dynamic range in excess of 10,000. The principle of operation is described and operating instructions and specifications are given. The theory of operation of the instrument is presented: the analog measurement circuit, integrator, and control logic circuit are explained. Schematics and circuit diagrams are given. J.D.H.

N81-24351*# New Mexico Univ., Albuquerque. Dept. of Electrical and Computer Engineering.
STUDY OF THE PHOTOVOLTAIC EFFECT IN THIN FILM BARIUM TITANATE Semiannual Report
W. W. Grannemann and V. S. Dharmadhikari May 1981 11 p (Grant NAG1-95)
(NASA-CR-164346; UNME-268(81)NASA-931-1) Avail: NTIS HC A02/MF A01 CSCL 09C

The photoelectric effect in structures consisting of metal deposited barium titanate film silicon is described. A radio frequency sputtering technique is used to deposit ferroelectric barium titantate films on silicon and quartz. Film properties are measured and correlated with the photoelectric effect characteristics of the films. It was found that to obtain good quality pin hole free films, it is necessary to reduce the substrate temperature during the last part of the deposition. The switching ability of the device with internal applied voltage is improved when applied with a ferroelectric memory device. E.A.K.

N81-24352# Centre de Recherches en Physique de l'Environnement, Issy-les-Moulineaux (France).
A CONTROL UNIT FOR A COMMUTATION MATRIX WITH A VIEW TO TIME DIVISION MULTIPLE ACCESS WITH COMMUTATION ON BOARD A SATELLITE [UNITE DE COMMANDE POUR UNE MATRICE DE COMMUTATION EN VUE DE L'ACCES MULTIPLE A REPARATION DANS LE TEMPS AVEC COMMUTATION A BORD SATELLITE]
Y. deJavel and J. Marque Jul. 1980 28 p In FRENCH
(CRPE-NT-86) Avail: NTIS HC A03/MF A01

The need for a control unit for a commutation matrix was realized during a CRPE program investigating time division multiple access. The principle of control, the characteristics of the unit developed, and its performance with a commutation matrix at baseband are discussed. The quartz oscillator, mode sequencing, and data processor are described as well as the logic and programs used. The control unit developed serves as a basis for defining a test program aimed at simulating time division multiple access with commutation onboard. Transl. by A.R.H.

N81-24353# California Inst. of Tech., Pasadena.
LOW LOSS FLEXIBLE DIELECTRIC WAVEGUIDE FOR MILLIMETER-WAVE TRANSMISSION AND ITS APPLICATION TO DEVICES Annual Technical Report, 1 Sep. 1979 - Nov. 1980
William B. Bridges Mar. 1981 89 p refs Prepared in cooperation with Hughes Research Labs., Malibu, Calif.
(Contract N00014-79-C-0839; RR0210203)
(AD-A097821; SRO-0005-1; ONR-81-1) Avail: NTIS HC A05/MF A01 CSCL 09/1

Dielectric properties have been measured at 94 GHz for thallium halide materials KRS-5 and KRS-6 using Fabry-Perot resonance transmission and short-waveguide reflection in dielectric-filled waveguide section. The dielectric constants are 31-32 for KRS-5 and 28-31 for KRS-6; the loss tangents are .02 for both. These values predict a waveguide loss of 8 dB/cm for a closely-confined HE sub 11 mode in KRS-5 at 94 GHz. Difficulties in coupling to such high dielectric constant fibers have so far prevented direct measurement, but scale model studies at 10 GHz yield a successful coupling technique to the HE sub 11 mode through an intermediate dielectric. Propagation in a 0.5 mm diameter KRS-5 fiber was observed with 0.2 dB/cm loss, much lower than that predicted for HE sub 11; the as-yet unidentified mode has a phase velocity about c, but small external fields and less than 1.5 dB loss from a 90 deg, 20 cm radius bend. Propagation constants for KRS-5 waveguides were calculated and losses estimated for various designs. A loosely coupled HE sub 11 KRS-5 fiber with foamed-teflon cladding could exhibit 3 dB/meter loss, with 3 dB/meter additional loss from 60 cm radius bends. A simple theory of relative quiding properties for multilayer cylindrical waveguides is given. GRA

N81-24354# Westinghouse Defense and Electronic Systems Center, Baltimore, Md.
FLEXIBLE PRINTED CIRCUITS WITH INTEGRAL MOLDED CONNECTORS. A MANUFACTURING METHODS AND TECHNOLOGY PROGRAM Final Report, Aug. 1979 - Nov. 1980
James A. Henderson 12 Mar. 1981 143 p refs

(Contract DAAK40-79-C-0212)
(AD-A098024; Rept-81-0209) Avail: NTIS HC A07/MF A01 CSCL 09/1

This is the final report of the program on Flexible Printed Circuits with Integral Molded Connectors (Flexicon). Performed under contract with the U.S. Army Missile Command, Redstone Arsenal, Alabama, it concentrated on the improvement of Flexible Printed Wiring (FPW) terminations for cable to cable, cable to printed wiring board, and cable to chassis applications. During the course of this program, several significant advances have been made in termination processes as well as in automated facility configuration and operation. This report details these development, referencing several additional documents and reports. The final outcome can be simply summarized. Through the use of industrial laser technology, new high speed epoxy developments, and microprocessor controlled automation, processes for termination of FPW to connectors have been developed which can result in 6 to 1 cost reduction of terminated systems with significantly improved system reliability and maintainability. GRA

N81-24355# Westinghouse Defense and Electronic Systems Center, Baltimore, Md.
FLEXIBLE PRINTED CIRCUITS WITH INTEGRAL MOLDED CONNECTORS
Richard L. Hall 12 Mar. 1981 50 p
(Contract DAAK40-79-C-0212)
(AD-A098025; Rept-81-0210) Avail: NTIS HC A03/MF A01 CSCL 09/1

Three new processes used in termination of Flexible Printed Wiring (FPW) to connectors were developed on this program. They are laser ablation (removal) of insulation by CO2 Laser, laser welding by Nd:YAG Laser, and liquid injection molding of small parts. The integration of these processes into a fully automated facility capable of one assembly per minute production was then projected (Automated Facility Report). Author (GRA)

N81-24356# Texas Instruments, Inc., Dallas.
L-BAND FRONT END SAW FILTERS Final Report, Apr. 1979 - Nov. 1980
B. R. Potter Apr. 1981 83 p refs
(Contract DAAK20-79-C-0257)
(AD-A097977; DELET-TR-79-0257-F) Avail: NTIS HC A05/MF A01 CSCL 09/5

The theory and design of L-band SAW filters for the Global-Positioning System (GPS) RF front end is described. Filters on lithium niobate with loss as low as 4.5 dB at 1233 MHz have been constructed and tested. Filters on ST-quartz have also been designed, fabricated and tested. These devices have insertion loss on the order of 14 to 16 dB and frequency sidelobes of -47 dB with only one weighted transducers. Withdrawal weighted group-type transducers were also designed. Author (GRA)

N81-24357# Naval Postgraduate School, Monterey, Calif. Dept. of Mechanical Engineering.
THE STUDY OF A ROTATING-HEAT-PIPE-COOLED ELECTRIC MOTOR M.S. Thesis
Gerhard Otto Immel Dec. 1980 53 p refs
(AD-A098083) Avail: NTIS HC A04/MF A01 CSCL 13/1

The steady state temperatures of a conventional, 15 HP electric motor were compared to those of a rotating heat pipe cooled motor under identical loading conditions. Fourteen thermocouples were used to measure temperatures at various locations within the motor. Seven of these were placed in rotating parts of the motor and were recorded through a mercury slip ring unit. Tests were made with the electric motor in its original configuration (i.e., with a solid shaft), with its solid shaft replaced by a rotating heat pipe and with this heat pipe unit containing segmented external fins to increase air cooling. The modifications did not show a decrease of motor temperatures. This was probably due to a lack of cooling air through the motor casing. Recommendations for future work are included. GRA

N81-24358# Naval Ocean Systems Center, San Diego, Calif.
PERFORMANCE OF LIGHT-EMITTING DIODES UNDER HYDROSTATIC PRESSURE Final Report, May - Sep. 1980
G. A. Garcia Jan. 1981 18 p
(AD-A097722; NOSC-TR-651) Avail: NTIS HC A02/MF A01 CSCL 09/1

The effect of hydrostatic pressure on two types of light-emitting diodes is presented. Emission characteristics and source-to-optical-fiber coupling performance were examined under conditions which simulate those found in a fluid-filled, pressure-equalizing enclosure. Minimal changes in either emission or coupling characteristics were observed at pressures up to 10,000 psi. Author (GRA)

N81-24359# Lockheed Missiles and Space Co., Sunnyvale, Calif. Advanced Systems Div.
HIGH CONTRAST CRT FOREFACEPLATE Interim Report, 19 Jan. - 18 May 1980
T. G. Maple and I. D. Liu Fort Monmouth, N.J. Army Electronics Research and Development Command Dec. 1980 162 p refs
(Contract DAAK20-79-C-0280; DA Proj. 1L1-62705-AH-94)
(AD-A098091; LMSC/D767730; DELET-TR-79-0282-2; IR-2)
Avail: NTIS HC A08/MF A01 CSCL 09/1

The objective of this program is the development of a high contrast, two color CRT faceplate employing evaporated thin film phosphors and nonreflective backing, utilizing 1710 glass and also sapphire substrates. Results of the Eu optimization study show that La2O2S:6.5 a/o Eu meets the technical requirements for IPL red. Faceplates Lots no. 1 and no. 2 were delivered to ERADCOM. Distortion has been eliminated by an increase of preheat time prior to the H2 + SO2 treatment. Author (GRA)

N81-24360# Norden Systems, Inc., Norwalk, Conn.
HIGH CONTRAST CRT MODULE Research and Development Technical Report, 1 Oct. 1979 - 31 Mar. 1980
Michael Kalmanash Feb. 1981 39 p refs
(Contract DAAK20-79-C-0290; DA Proj. 1L2-6374-DF-32)
(AD-A097727; Rept-1310-R-0020; DELET-TR-79-0290-1)
Avail: NTIS HC A03/MF A01 CSCL 17/2

The objective of this program is the development of a miniature high contrast color CRT module compatible with the AN/APR-39 system, except for an increase in overall length compared to the monochrome AN/APR-39 display indicator. The initial interim period of this program has resulted in the development of an initial breadboard system, and the completion of packaging feasibility and initial design for the Advanced Development Model. GRA

N81-24361# McGraw-Edison Power Systems Div., Canonsburg, Pa. Systems Engineering Section.
STUDY OF DISTRIBUTION SYSTEM SURGE AND HARMONIC CHARACTERISTICS Final Report
R. E. Owen and M. F. McGranaghan Nov. 1980 269 p refs
Prepared in cooperation with United Technologies Corp. South Windsor, Conn., and Systems Control, Inc., Palo Alto, Calif. Sponsored by Electric Power Research Inst.
(EPRI Proj. 1024-1)
(EPRI-EL-1627) Avail: NTIS HC A12/MF A01

The characteristics of electrical noise and power harmonics from power converters and other harmonic sources, as well as the effects of such noise and harmonics on distribution system equipment and operation are described. Power system surges and their effects on converter equipment are also described. Test methodology and instrumentation are described, and the measured results are presented. The implications of this high frequency noise on power line communication systems are reported. DOE

N81-24362# Bendix Corp., Kansas City, Mo.
IMPROVED TECHNIQUES TO MONITOR THIN FILM CHARACTERISTICS FOR RELIABLE HYBRID MICROCIRCUIT FABRICATION
L. R. Zawicki and N. C. Thomas Jun. 1980 18 p refs Presented at 16th Ann. Symp. of the New Mexico Chapter of the Am. Vacuum Soc., Santa Fe, N. Mex., 6 May 1980
(Contract DE-AC04-76DP-00613)
(BDX-613-2453; CONF-800519-2) Avail: NTIS HC A02/MF A01

The development, testing, and uses of an edge monitor for monitoring the characteristics of thin metallic films used in the fabrication of hybrid microcircuits are described. The data obtained on this quality control equipment demonstrated improved

techniques for monitoring thin film characteristics for reliable hybrid microcircuit fabrication. This was accomplished through the design of a specialized circuit, an integral part of the product substrate to be tested that enhances the effects of degradation mechanisms, both mechanically and electrically. Correlation of mechanical and/or physical characteristics with electrical data was demonstrated. When coupled with a minicomputer test set with controlling and data retention capabilities, the system offers a useful tool for production process monitoring, diagnostic evaluation, or developmental efforts. DOE

N81-24363# Sandia Labs., Albuquerque, N. Mex.
GALLIUM PHOSPHIDE HIGH-TEMPERATURE BIPOLAR JUNCTION TRANSISTOR
T. E. Zipperian, L. R. Dawson, and R. J. Caffin Mar. 1981 3 p refs Presented at the High Temp. Electron. Conf., Tucson, Ariz., 25 Mar. 1981
(Contract DE-AC04-76DP-00789)
(SAND-81-0139C; CONF-810316-1) Avail: NTIS HC A02/MF A01

Preliminary results are reported on the development of a high temperature (more than 350 C) gallium phosphide bipolar junction transistor (BJT) for geothermal and other energy applications. This four layer (p(+)n(-)pp(+) structure was formed by liquid phase epitaxy using a supercooling technique to insure uniform nucleation of the thin layers. Magnesium was used as the p-type dopant to avoid excessive out-diffusion into the lightly doped base. By appropriate choice of electrodes, the device may also be driven as an n-channel junction field-effect transistor. The gallium phosphide BJT is observed to have a common-emitter current gain peaking in the range of 6 to 10 (for temperature from 20 C to 400 C) and a room temperature, punchthrough-limited, collector-emitter breakdown voltage of approximately 6V. Other parameters of interest include an foub-t = 400 KHZ (at 20 C) and a collector base leakage current = 200 micro A (at 350 C). DOE

N81-24364# Los Alamos Scientific Lab., N. Mex.
THREE DIMENSIONAL SPACE CHARGE CALCULATION METHOD
Walter P. Lysenko and E. A. Wadlinger 1981 6 p refs Presented at the Particle Accelerator Conf., Washington, D.C., 11-13 Mar. 1981
(Contract W-7405-eng-36)
(LA-UR-81-341; CONF-810314-3) Avail: NTIS HC A02/MF A01

A method is presented for calculating space charge forces suitable for use in a particle tracing code. Poisson's equation is solved in three dimensions with boundary conditions specified on an arbitrary surface by using a weighted residual method. Using a discrete particle distribution as our source input, examples are shown of off-axis, bunched beams of noncircular cross-section in radio-frequency quadrupole and drift tube linac geometries. DOE

N81-24365# ECON, Inc., Princeton, N. J.
EVALUATION OF HIGHER DISTRIBUTTON AND/OR UTILIZATION VOLTAGES Final Report
G. A. Hazelrigg, Jr. Jan. 1981 41 p refs
(Contracts DE-AC01-78ET-20505; DE-AC01-78ET-2866)
(DOE/RA-20505/01) Avail: NTIS HC A03/MF A01

An electric energy distribution/utilization system cost analysis model is presented for exploring cost tradeoffs and optimizing system configuration. The model focuses on the treatment of residential and light commercial service areas with time varying load characteristics, including customer load profile changes, per customer load growth, and service area population growth. Applications of the model include providing insight on: the selection of primary and secondary voltages; conductor sizing; distribution transformer sizing, change out policies and copper-to-core-loss ratio; and limits on allowable voltage variation at the service entrance. Examples are provided to illustrate model capabilities. DOE

N81-24366# Gould-Brown Boveri, Greensburg, Pa.
STUDY OF ARC BY-PRODUCTS IN GAS-INSULATED EQUIPMENT Final Report
A. Baker, R. Dethlefsen, J. Dodds, N. Oswalt, and P. Vouros Dec. 1980 111 p refs
(EPRI Proj. 1204-1)
(EPRI-EL-1646) Avail: NTIS HC A06/MF A01

A chemical data base was developed for SF6 decomposition products as generated by electrical discharges within gas insulated equipment to serve as a basis for unified handling procedures of faulted SF6 equipment and disposal of the arc products. An analysis capability was to be developed that could be used by utilities for incipient and actual fault analysis on SF6 insulated power equipment. Arced SF6 gas and solid samples were generated in test devices which simulate SF6 circuit breakers or SF6 insulated bus. Actual production hardware and procedures were used for assembly of the test devices. Fault arc currents ranged between 15 kA and 50 kA. Arced SF6 samples were obtained and shipped in stainless steel cylinders. Gaseous arc products were analyzed with a combination of gas chromatography mass spectrometry. DOE

N81-24367# Max-Planck-Institut fuer Festkoerperforschung, Stuttgart (West Germany).
REAL TIME X-RAY TOPOGRAPHY FOR A BETTER YIELD FROM SEMICONDUCTOR DEVICES Final Report
Werner Hartmann Bonn Bundesministerium fuer Forschung und Technologie Jun. 1980 34 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-018; ISSN-0340-7608) Avail: NTIS HC A03/MF A01

An experimental arrangement for real time X-ray observation of dynamic strain fields and defects in crystal structures was developed. The mechanical and geometrical design of the setup is presented. The characterization of the X-ray fluorescent screen is treated, and the digital video monitoring of the screen is described. A high temperature furnace and a gas phase epitaxial reactor were used in experiments. Analysis results are reported on the temperature dependence of the initiation and motion of crystal dislocation structures as part of the strain field of a surface indentation. The temperature dependence of the strain field along a Si/SiO2 interface is also formulated. The behavior of misfit dislocations is shown during the epitaxial growth of Ge on GaAs. The application possibilities of this system are also demonstrated for experiments with synchrotron radiation. The improvement of semiconductor yield through a better understanding of crystal growth dynamics is emphasized. Author (ESA)

N81-24368# AEG-Telefunken, Frankfurt am Main (West Germany). Forschung und Entwicklung.
BASIC INVESTIGATIONS ON THE OPTIMIZATION OF SOLID PLASTIC INSULATIONS Final Report
Manfred Saure and Hermann Franke Bonn Bundesministerium fuer Forschung und Technologie Aug. 1980 224 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-044; ISSN-0340-7608) Avail: NTIS HC A10/MF A01

The electrical properties of various plastic insulation materials were studied. Primarily, extruded polyolefin cables, mica tape insulation for electrical machines, and casting resin compounds used in transformers were considered. The intrinsic electrical strength of these solid dielectrics was determined. Characterization test methods cover electrical breakdown, electrical treeing, and voltage stabilizing properties under high voltage conditions. Inhomogeneities in thick wall insulation due to manufacturing practices were evaluated. Author (ESA)

N81-24369# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.
MEASUREMENTS OF ENERGY LOSSES IN MONOFILAMENTARY SUPERCONDUCTORS
M. Asdente, G. Cavalleri, M. C. Pascucci, and A. M. Ricca Dec. 1979 6 p refs Presented at 15th Intern. Congr. of Refrig., Venice, 23-29 Sep. 1979 Sponsored by Ente Nazioniale per l'Energia Elettrica
(CISE-1566) Avail: NTIS HC A02/MF A01

The results of ac loss measurements on a multilayered Nb and Nb3Al monofilament are presented. The sample wire consisted of a multilayered Nb-Al filament structure with Nb layers 1 micron

thick, wound on an insulating cylinder in an antiinductive configuration. The Nb3Al compound was formed using a thermal process. The measurements were done at 4.2, 7.5 and 11 K. A linear relationship in the log-log plot of power versus intensity is obtained. The exponent is monotonically decreasing with the temperature and is always higher then the value predicted by Bean's model. Author (ESA)

N81-24370# AEG-Telefunken, Heilbronn (West Germany). Geschaeftsbereich Halbleiter.

DESIGN METHODS FOR COMPLEX MOS SYSTEMS Final Report

Paul Sieber Bonn Bundesministerium fuer Forschung und Technologie Aug. 1980 86 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-80-086; ISSN-0340-7608) Avail: NTIS HC A05/MF A01

Methods and aids for the design of complex MOS systems were improved and tested on prototypes of LSI components. Subcircuit libraries for both manual and computer layout were extended to reduce development time. By improvements in circuit design, the yield of the CP3F microprocessor and of ultrasonic remote control chips was enhanced. The testing of LSI circuits with automated test systems was optimized, and by standardization of the procedures, a shorter development time for test programs and a better evaluation of components and test structures was achieved. Test programs for products in production were optimized as to testing time. Introduction of the n-channel Si-gate process is discussed, and the design and testing of appropriate test structures are shown. Author (ESA)

N81-24371# AEG-Telefunken, Heilbronn (West Germany). Geschaeftsbereich Halbleiter.

ION IMPLANTATION N-CHANNEL MOS TECHNOLOGY Final Report

Peter Conze Bonn Bundesministerium fuer Forschung und Technologie Oct. 1980 72 p refs In GERMAN; ENGLISH summary Sponsored by Bunderministerium fuer Forschung und Technologie

(BMFT-FB-T-80-092) Avail: NTIS HC A04/MF A01

An advanced n-channel Si-gate process for LSI circuits with supply voltages up to 20 V was developed. The values allowed for minimum width and minimum space in the masks determining the chip density are 5 and 7.5 microns, respectively. Technological features of this process include: boron implantation and self registered local oxidation in the field area; gate oxidation with 3% HCl added to the oxygen atmosphere to improve dielectric breakdown; and covering of the poly-Si-structure with a reflow glass ensuring good aluminum step coverage. Enhancement and depletion type MOS transistors were realized, implanting boron and phosphorus in the channel region. Drawing on experience gained with an older p-channel process, electrical characteristics of these devices were determined, and process related improvements are pointed out. Author (ESA)

N81-24372# AEG-Telefunken, Heilbronn (West Germany). Geschaeftsbereich Halbleiter.

BURST NOISE INVESTIGATIONS ON BIPOLAR TRANSISTORS IN INTEGRATED CIRCUITS Final Report

Kurt-Dieter Hinztmann Bonn Bundesministerium fuer Forschung und Technologie Oct. 1980 32 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-80-096; ISSN-0340-7608) Avail: NTIS HC A03/MF A01

Burst noise as well as 1/f noise associated with bipolar transistors are identified as the main component of low frequency noise in certain amplifier and pulse processing circuits. This noise signal is correlated with the presence of heavy metal impurities in the vicinity of the emitter base insulating layer. The accumulation of these impurities was observed as being favored by epitaxial process induced crystal lattice defects. The use of Si planar technology with a horizontal reactor for epitaxy results in fewer crystal lattice defects. Simultaneously, an improved gettering process reduces the presence of heavy metal impurities. Enhanced integrated circuit yield is obtained. Author (ESA)

N81-24373# Danish Research Center for Applied Electronics, Hoersholm.

THREE TERMINAL VOLTAGE REGULATORS. AN EVALUATION OF FIXED 5V POSITIVE VOLTAGE REGULATORS. RELIABILITY AND STABILITY UNDER VARIOUS ENVIRONMENTAL AND LOAD CONDITIONS

Claes Hansen and Birger Schneider Sep. 1980 48 p (ECR-99) Avail: NTIS HC A03/MF A01

The capability of IC regulators to withstand thermal cycling over a wide range of operating conditions was determined. The dependence of thermal fatigue, as a failure mechanism, on the quality of the die-mounting is verified. Components from four manufacturers, including seven variants, were tested for different properties, i.e., change in power dissipation (power cycling), high temperature reverse bias, high temperature storage life, temperature cycling (zero voltage), and steady state operating life. Power cycling was for 24,000 cycles while test duration for the remaining tests was 1000 hr each. A total of 450 devices (five types of encapsulation) were tested, resulting in 12 failures. Four of the seven variants, including two low current ones, have no failures. All variants except one appear to have reasonable or even excellent performance. The weak variant shows poor power cycling performance as well as failures during temperature cycling and poor steady state operating life. Author (ESA)

N81-24374# Danish Research Center for Applied Electronics, Hoersholm.

AN EVALUATION OF TYPE 2708, 2716, 2532, 2732 TYPES OF ULTRAVIOLET ERASABLE EPROM'S, INCLUDING RELIABILITY AND LONG TERM STABILITY

Birger Schneider, Claes Hansen, and Finn Fregil Nov. 1980 86 p refs Original contains color illustrations

(ECR-102) Avail: NTIS HC A05/MF A01

Seventeen erasable/electrically programmable read-only memory (EPROM) variants were investigated. Eight variants belong to the 2708 familiy, seven to the 2716 family, and two to the 2532/3732 families. In all 96, 56 and 7 devices were tested, respectively. The technology and structure of EPROM's are described. The determination of reliability is outlined; a life curve model and failure mechanisms for N-channel MOS EPROM's are discussed. The test plan (in general 2000 hr exposure time for each component) is presented. Elevated temperature storage life and elevated temperature dynamic life were measured. In the 2708 family a total of 12 failures occured of which 10 are catastrophic and 2 are degradational failures. In the 2716 family 20 failures occurred of which 11 are catastrophic, 6 degradational and 3 marginal degradational failures. The number of device hours in the 2532/2732 families is rather limited compared with the two other families. Within the 2532/2732 families 1 catastrophic and 1 degradational failure occurred. Seven out of the 17 variants had no failures. contents.

Author (ESA)

N81-24375# Royal Military Coll. of Science, Shrivenham (England). Electrical and Electronic Engineering Dept.

ADD-ON COMPONENTS FOR CHEAP THICK FILM MICROWAVE CIRCUITS Final Report

M. J. Mead and E. H. England 1979 36 p refs

(TN-RT/119) Avail: NTIS HC A05/MF A01

The feasibility of (1) surface mounted circulators for cheap microwave integrated circuits, and (2) hybrid microwave integrated circuit thin film cut-off filters for thick film circuits, was investigated. Two ways of making a surface mounted circulator by adding ferrite to the surface of a thick film circuit in order to avoid any machining of the substrate were studied. While performance results for a disk circulator, demonstrated in the laboratory, are encouraging, attempts to produce a lumped element circulator failed. For the other component, a filter, a technique of implanting this component on otherwise completed thick film substrates, allowing the use of high definition components at minimal cost, was sought. A process for the transfer of thin film component patterns from a carrier to the main substrate is defined. The performance of a stop-band filter transferred into thick film and copper laminate circuits is satisfactorily compared with wholly thin film constructed components. Author (ESA)

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N81-24376 Illinois Univ. at Urbana-Champaign.
GROUP INVARIANCE PROPERTIES OF TRANSIENT NONLINEAR HEAT CONDUCTION PROBLEMS Ph.D. Thesis
William John Croisant, Jr. 1980 788 p
Avail: Univ. Microfilms Order No. 8108474

The variation of the thermal properties with temperature complicates the analysis of transient heat conduction problems because the governing partial differential equations are nonlinear. The analytical situation in some cases is further complicated by a volumetric heat generation (or dissipation) rate which is also a function of temperature. These areas collectively constitute the general nonlinear heat conduction phenomenon of interest. The analytical situation for nonlinear partial differential equations is complicated by the fact that most of the standard linear mathematical techniques are of little or no use in attacking nonlinear problems. In this respect, the principles of continuous transformation groups are of interest because they can be used to seek exact solutions of nonlinear as well as linear transient heat conduction problems. The group theoretic approach is based upon the fundamental principle of invariance under a one or multiparameter group of point transformations, a property which can be used to deduce transformations of variables that reduce the number of independent variables in a partial differential equation or reduce the order of an ordinary differential equation. Dissert. Abstr.

N81-24377 State Univ. of New York, Stony Brook.
AN INVESTIGATION OF THE INFLUENCE OF MOMENTUM DEFECTS IN THE FREE STREAM, ON THE FLOW OVER LIFTING SURFACES Ph.D. Thesis
Suresh Madhavan 1981 77 p
Avail: Univ. Microfilms Order No. 8109031

An effort was made to solve the Navier-Stokes equations numerically for appropriate boundary conditions. Using a computational method developed during the course of the research, the effects of a confluent wake on boundary layer formation and separation are demonstrated. This work leads to the solution of the multi-element foil problem. A discussion of some methods of solution that were tried out and the method used to solve the problem are included. Dissert. Abstr.

N81-24378 California Univ., Santa Barbara.
A COMPUTATIONAL MODEL FOR THE LAMINAR FLOW BOUNDARY LAYER IN A THERMALLY DRIVEN VORTEX Ph.D. Thesis
Edward Stanley Wilbarger, Jr. 1980 109 p
Avail: Univ. Microfilms Order No. 8108372

The model was developed using the method of finite differences. The complete, compressible form of the steady state Navier-Stokes equations, the continuity equation and energy equation were employed. A variable step size computational grid was used to conserve computer storage space. Laminar flows were computed for both rigid body outer flow and combined potential-rigid body core outer flow for isothermal and thermally driven cases. The validity of the model and the computational scheme is confirmed by comparison of the finite difference solution with the similarity solution for rigid body flow over an infinite plane. In order to obtain a suitable set of boundary conditions at large radial distance, the Stewartson profiles for radial and tangential velocities near the edge of a finite disc were used. In addition, a set of polynomial profiles which satisfy the boundary conditions were used. These profiles prove to be satisfactory and produce results that agree qualitatively with other results. Dissert. Abstr.

N81-24379 Minnesota Univ., Minneapolis.
EFFECT OF PLENUM LENGTH AND DIAMETER ON TURBULENT HEAT TRANSFER IN A DOWNSTREAM TUBE AND ON PLENUM-RELATED PRESSURE LOSS Ph.D. Thesis
Sai Chuen Lau 1980 242 p
Avail: Univ. Microfilms Order No. 8109460

The heat transfer experiments were supplemented by pressure drop and flow visualization experiments. Air was the working fluid for the heat transfer and pressure drop tests, whereas water was used for the flow visualizations. The heat transfer apparatus was specially designed to defend against extraneous conduction heat losses by guard heating/cooling of the electrical power leads and by thermally isolating the heated test section from the plenum and the surroundings. Three parameters were varied throughout the experiments. One of these, the ratio L/d of the plenum length to the test section diameter ranged from one to ten. A second parameter, the ratio D/d of the plenum to tube parameter, took on values of three and six. The third parameter was the Reynolds number, which varied between 5,000 and 60,000. There is substantial enhancement of the local heat transfer coefficients in the tube due to processes which take place in the plenum. Dissert. Abstr.

N81-24380 Washington Univ., Seattle.
BENARD CONVECTION WITH STRONGLY TEMPERATURE-DEPENDENT VISCOSITY Ph.D. Thesis
Dean Stuart Oliver 1980 158 p
Avail: Univ. Microfilms Order No. 8109757

The dependence of convection in a horizontal fluid layer on the Rayleigh number, and the viscosity variation, was investigated. The theory of the investigation depends on a perturbation expansion of the Rayleigh number, for values of eta up to 15 and for three convective planforms: rolls, squares, and hexagons. Dissert. Abstr.

N81-24381 Illinois Univ. at Urbana-Champaign.
INFILTRATION OF A TWO-STATE COMPRESSIBLE FLUID THROUGHLY A LINEARLY DEFORMED, POROUS, ELASTIC, FISSURED ROCK Ph.D. Thesis
Mamdough Youssef Khaled 1980 140 p
Avail: Univ. Microfilms Order No. 8108561

A theory is formulated for a double porosity medium with two-component vector porosity field. In particular, the performance of a fissured rock medium subjected to a variable load in the space and time domain is considered. The deformation flow interaction phenomenon is described by five, linear, partial differential equations which contain nine unknown coefficients. The evaluation of coefficients is achieved through the design of an experimental measurement to yield their numerical values. The mixed initial boundary value problem is formulated by combining the five field equations with sufficient initial and boundary conditions. The finite element weighted residual method employing the Galerkin approach is selected for the solution of the time dependent problem. A finite element computer program is developed to calculate solid displacements and stresses, fluid pressure and flows. The numerical examples include a one dimensional column, a two dimensional layer, and a two dimensional halfspace of fissured rock. Dissert. Abstr.

N81-24382 Stanford Univ., Calif.
INERTIAL EFFECTS IN CLOSED CAVITY FLOWS AND THEIR INFLUENCE ON DROP BREAKUP Ph.D. Thesis
John Francis Brady 1981 172 p
Avail: Univ. Microfilms Order No. 8108898

An exact similarity solution to the steady Navier-Stokes equations for the flow in an infinitely long channel or tube with an accelerating surface velocity is presented. Axisymmetric nonswirling flow in a tube is investigated. The structure of the flow in a very long tube when the Reynolds number R exceeds 10.25 is studied. It is shown that the problem of determining the motion in a long finite tube is equivalent to that of selecting the initial condition for the boundary layer equations that properly takes into account the presence of the reverse flow. Numerical solutions are obtained for the flow in a finite tube for Reynolds numbers up to 70. The same change in structure brought about by the returning fluid occurs in a finite two dimensional channel at R = 57. The influence of the internal inertia on the deformation and breakup of a slender drop suspended in an axisymmetric extensional flow is studied. The deformation and critical conditions at breakup are obtained. It is proven that the shape of a slender

drop in an extensional flow must be an analytic function. A family of solutions to the Stokes equations for cylindrical geometry is developed. Dissert. Abstr.

N81-24383 Missouri Univ. -Columbia.
SCATTERING FROM A POROUS SPHERE Ph.D. Thesis
Ram Prakash Kochhar 1980 119 p
Avail: Univ. Microfilms Order No. 8108817

The pressure distribution function inside the porous medium satisfies the telegrapher's equation. In the case of a plane harmonic wave, the wave number is complex to account for the dissipation in the porous medium. Reflection of a plane harmonic wave from a porous sphere is analyzed. The uniqueness of the scattering problem for a general boundary (compact and connected set) is also discussed. In terms of a reduced wave equation, the boundary conditions at the interface involve a complex parameter. No such complex parameter appears in the boundary conditions at the interface when the scattering problem is formulated in terms of the pressure and velocity distribution function. Because of the boundary conditions, the uniqueness theorem is formulated in terms of the original system of equations. Using the modified Watson's transformation, the high frequency estimates are derived. The discussion of poles in Debye's expansion is included.
Dissert. Abstr.

N81-24384*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SYSTEM FOR MONITORING PHYSICAL CHARACTERISTICS OF FLUIDS Patent Application
Eugene Trinh (JPL) and Taylor G. Wang, inventors (to NASA) (JPL) Filed 23 Mar. 1981 16 p
(Contract NAS7-100)
(NASA-Case-NPO-15400-1; US-Patent-Appl-SN-246774) Avail: NTIS HC A02/MF A01 CSCL 20D

An apparatus and method are described for measuring physical characteristics of a fluid, by placing a drop of the fluid in a bath of a second fluid and passing acoustic waves through the bath. The applied frequency of the acoustic waves is varied, to determine the precise value of a frequency at which the drop undergoes resonant oscillations. The resonant frequency indicates the interfacial tension of the drop in the bath, and the interfacial tension can indicate physical properties of the fluid in the drop. NASA

N81-24385# ARO, Inc., Arnold Air Force Station, Tenn.
CONSET PROGRAM AT ARNOLD ENGINEERING DEVELOPMENT CENTER AEDC Final Report, Jul. 1973 - 1979
W. D. Williams and J. W. L. Lewis AEDC Sep. 1980 64 p refs Sponsored by AF
(AD-A089442; AEDC-TR-80-16) Avail: NTIS HC A04/MF A01 CSCL 20/4

An experimental program on the onset and growth of condensation in expansion flow fields with regard to nozzle geometry, reservoir conditions, molecular parameters, and flow composition was conducted. Pure gas expansions, as well as binary and ternary gas mixture expansions and the plume of a monopropellant hydrazine thruster were also explored. Laser Rayleigh and laser Raman scattering, mass spectrometric sampling, and electron beam fluorescence were used as nonperturbing flow diagnostics. It is concluded that monopropellant plumes can be successfully simulated using gas mixtures, to study condensation phenomena in the plume. E.A.K.

N81-24386# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
AN ELECTRO-IMPULSE WATER JET
G. A. Atonov, Yu N. Golovko, and A. M. Krivoruchko (Academy of Sciences (USSR), Donets) 1981 9 p refs Transl. into ENGLISH from Energetika (Czechoslovakia), no. 7, 1979 p 77-81
(NRC/CNR-TT-1992; ISSN-0077-5606) Avail: NTIS HC A02/MF A01

The operating principles of an electro-impulse water jet are described. In the normal impulse water jet, the water is compressed and ejected through a nozzle by the action of a piston which is actuated by compressed gas; while in the electro-impulse water jet the role of the piston is played by a vapor-gas void which appears as a result of an electrical discharge in the water. The electro-impulse water jet has a number of advantages such as simplicity of design, as well as the absence of moving parts, the ease with which the firing process can be automated, and the rapid firing rate. L.F.M.

N81-24387*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOME FLOW PHENOMENA ASSOCIATED WITH ALIGNED, SEQUENTIAL APERTURES WITH BORDA-TYPE INLETS
Robert C. Hendericks and T. Trent Stetz May 1981 63 p refs
(NASA-TP-1792; E-479) Avail: NTIS HC A04/MF A01 CSCL 20D

Choked flow rate and pressure profile data were taken and studied for a configuration consisting of four axially aligned, sequential Borda tubes of 1.9 length diameter ratio with separation distances of 0.8 and 30 tube diameters. For either case the flow rate data could be represented by a flow coefficient reduced temperature plot. At a separation distance of 30 tube diameters the pressure profiles dropped sharply at the entrance and recovered within each Borda tube; except at low temperatures, where fluid jetting through the last Borda tube occurred. At a separation distance of 0.8 tube jetting was prevalent, and application of a significant backpressure did not alter the jetting. These results agree with other data for tubes with Borda or sharp edge orifice inlets and with a water flow visualization study reported herein.
Author

N81-24388*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FORCED AND NATURAL CONVECTION IN LAMINAR-JET DIFFUSION FLAMES
John B. Haggard, Jr. Jun. 1981 24 p refs
(NASA-TP-1841; E-487) Avail: NTIS HC A02/MF A01 CSCL 20D

An experimental investigation was conducted on methane, laminar-jet, diffusion flames with coaxial, forced-air flow to examine flame shapes in zero-gravity and in situations where buoyancy aids (normal-gravity flames) or hinders (inverted-gravity flames) the flow velocities. Fuel nozzles ranged in size from 0.051 to 0.305 cm inside radius, while the coaxial, convergent, air nozzle had a 1.4 cm inside radius at the fuel exit plane. Fuel flows ranged from 1.55 to 10.3 cu cm/sec and air flows from 0 to 597 cu cm/sec. A computer program developed under a previous government contract was used to calculate the characteristic dimensions of normal and zero-gravity flames only. The results include a comparison between the experimental data and the computed axial flame lengths for normal gravity and zero gravity which showed good agreement. Inverted-gravity flame width was correlated with the ratio of fuel nozzle radius to average fuel velocity. Flame extinguishment upon entry into weightlessness was studied, and it was found that relatively low forced-air velocities (approximately 10 cm/sec) are sufficient to sustain methane flame combustion in zero gravity. Flame color is also discussed. Author

N81-24389*# National Aeronautics and Space Administration, Washington, D. C.
AIRCRAFT ENERGY EFFICIENCY PROGRAM: LAMINAR FLOW CONTROL TECHNOLOGY
1979 8 p
(NASA-TM-82352; NF-86/8-79) Avail: SOD HC CSCL 20D

Laminar flow control system design is analyzed with emphasis on surface and structural concepts, wing structures, leading edge contamination and suction unit configurations. S.F.

N81-24390*# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
SINGLE-PULSE BROAD-BAND ROTATIONAL CARS THERMOMETRY OF COLD N2 GAS Annual Review, 1 Mar. 1980 - 28 Feb. 1981
Richard K. Chang and D. V. Murphy 28 Feb. 1981 7 p refs (Contract NAG1-37)
(NASA-CR-164356) Avail: NTIS HC A02/MF A01 CSCL 20D

Coherent anti Stokes Raman scattering (CARS) from the pure rotational Raman lines of N2 was employed to measure

the instantaneous (10 nsec) rotational temperature of the gas at room temperature and below. An entire rotational CARS spectrum was generated by a single laser pulse using a broad bandwidth dye laser and was recorded on an optical multichannel analyzer. A best fit temperature obtained for individual experimental spectra by comparison with calculated spectra. Good agreement between CARS temperatures and thermocouple temperatures was observed. Author

N81-24391*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
REDUCTION OF THE TWO DIMENSIONAL STATIONARY NAVIER-STOKES PROBLEM TO A SEQUENCE OF FREDHOLM INTEGRAL EQUATIONS OF THE SECOND KIND
Ralph E. Gabrielsen Apr. 1981 12 p refs Prepared in cooperation with Army Aviation Research and Development Command
(NASA-TM-81272; A-8494; USAAVRADCOM-TR-81-A-10) Avail: NTIS HC A02/MF A01 CSCL 20D

Present approaches to solving the stationary Navier-Stokes equations are of limited value; however, there does exist an equivalent representation of the problem that has significant potential in solving such problems. This is due to the fact that the equivalent representation consists of a sequence of Fredholm integral equations of the second kind, and the solving of this type of problem is very well developed. For the problem in this form, there is an excellent chance to also determine explicit error estimates, since bounded, rather than unbounded, linear operators are dealt with. A.R.H.

N81-24392# Massachusetts Inst. of Tech., Cambridge. Dept. of Mathematics.
APPLICATIONS OF NUMERICAL CONFORMAL MAPPING Interim Report
Daniel I. Merion , Steven A. Orszag , and Moshe Israeli (Technion - Israel Inst. of Technology) 1981 37 p refs
(Grant AF-AFOSR-3405-77; AF Proj. 2304)
(AD-A098068; AFOSR-81-0391TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

The application of conformal mapping methods to the solution of free-surface flow problems is considered. Methods of numerical conformal mapping based on Fourier series are extended to handle efficiently problems with time-dependent boundaries. They are shown to be practicable only for moderately distorted geometries. Extensions of the Menikoff-Zemach method to 'breaking' geometries are presented. These latter methods are robust at quite large distortions, but degrade prematurely in time-dependent problems at amplitudes smaller than achieved by our recent vortex methods. Author (GRA)

N81-24393# Massachusetts Inst. of Tech., Cambridge. . Dept. of Mathematics.
THEORETICAL AND NUMERICAL ANALYSIS OF CONFORMAL MAPPING Ph.D. Thesis
Moshe Dubiner Jan. 1981 223 p refs
(Grant AF-AFOSR-3405-77; AF Proj. 2304)
(AD-A098067; AFOSR-81-0392TR) Avail: NTIS HC A10/MF A01 CSCL 12/1

Many numerical simulations, in particular that of a two dimensional incompressible free boundary flow, can be done by performing conformal mapping of the flow domain onto a half plane. The detailed behavior of the conformal mapping, which is closely related to the detailed behavior of the solution to a two dimensional Dirichlet problem, is analysed. A uniform asymptotic expansion to the conformal map of a slender domain is constructed. Its salient features are explained and later generalized by theorems valid for arbitrary domains. It is demonstrated that the conformal map onto a disk can not expand distances beyond a certain bound but can be extremely contracting. The logarithm of its derivative is shown to be well behaved. A general perturbation formula from an arbitrary domain to an arbitrary domain which preserves many features of the infinitesma' perturbation formula is derived, and its use is demonstrated on a fractal. These results utilize two estimates, correct up to a constant factor, of the conformal distance and the location of its geodesics. GRA

N81-24394# Michigan State Univ., East Lansing. Dept. of Mechanical Engineering.
AN EXPERIMENTAL STUDY OF TURBULENCE PRODUCTION MECHANISMS IN BOUNDARY LAYER FLOWS Interim Report, 1 Oct. 1979 - 30 Sep. 1980
Robert E. Falco Sep. 1980 27 p refs
(Grant AF-AFOSR-3703-78; AF Proj. 2307)
(AD-A098102; AFOSR-81-0398TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

The mechanism of turbulence production is identified. Simultaneous flow visualization and hot-wire anemometry have been used. A new scaling of the burst rate has been found. Author (GRA)

N81-24395# Aerospace Corp., El Segundo, Calif.
USER'S MANUAL FOR THE PLUME SIGNATURE CODE EAPROF Interim Report
Stephen J. Young Jan. 1981 65 p refs
(Contract F04701-80-C-0081; AF Proj. 5730)
(AD-A098141; TR-0081(6623)-1; AFRPL-TR-81-08) Avail: NTIS HC A04/MF A01 CSCL 17/5

A description and instructions for use of the plume signature code EAPROF are given. The code computes the transverse profiles of infrared emission and extinction within a fixed bandpass for an axisymmetric, axially uniform, cylindrical two-phase plume. The principal inputs are the radial distributions of gas temperature, pressure, and concentration and particle temperature and number density. An example application is made for a plume containing H2O as the gas species and Al2O3 as the particle species. GRA

N81-24396# Tennessee Univ., Tullahoma. Gas Diagnostics Div.
DEVELOPMENT OF MICROPROCESSOR-BASED LASER VELOCIMETER AND ITS APPLICATION TO MEASUREMENT OF JET EXHAUSTS AND FLOWS OVER MISSILES AT HIGH ANGLES OF ATTACK Final Technical Report
Kenneth E. Harwell, W. M. Farmer, J. O. Hornkohl, and E. Stallings Mar. 1981 75 p
(Contract N00174-79-C-0403; Grant DAAG29-77-G-0138)
(AD-A098166; GDFTR-81-2; ARO-14761.4-E) Avail: NTIS HC A04/MF A01 CSCL 17/8

During the past three years, personnel have developed a unique three-component laser velocimeter for the in situ measurement of particle and/or gas velocities in flow fields produced behind bodies at high angles of attack and in jet exhaust plumes. This report describes the development of the laser velocimeter and its subsequent application of the measurement of the velocity distribution and vortex structure in free jets and in flows over missiles at high angles of attack. GRA

N81-24397# Brobeck (William M.) and Associates, Berkeley, Calif.
REVIEW OF CURRENT STATUS OF HIGH FLUX HEAT TRANSFER TECHNIQUES. VOLUME 2: APPENDICES B, C AND D
M. Ulrickson Sep. 1980 125 p refs
(Contract W-7405-eng-48)
(UCRL-15321-Vol-2; WMB/A-4500-95-27.20-R1-Vol-2) Avail: NTIS HC A06/MF A01

An experimental evaluation of materials for use of limiters, wall armor, or beam dumps (LABD) is presented. A baseline design, a cost estimate for LABD, and alternatives to the LABD are discussed. Thermal shock testing was carried out using an electron beam gun, and the sample temperature was monitored by use of thermocouples on the back surface. Thermal fatigue tests were also executed. The lifetime of materials under normal operating conditions is determined by thermal fatigue affects. It was found that carbon (graphite), tungsten, copper, and molybdenum are the most suitable materials for LABD application. E.A.K.

N81-24398# Oak Ridge Gaseous Diffusion Plant, Tenn.
COMPARISON OF THE EFFECT OF NON-RANDOM SURFACE SCATTERING ON FREE-MOLECULE AND SLIP FLOW THROUGH CAPILLARIES
D. E. Fain Jul. 1981 24 p refs Presented at 12th Intern. Symp. on Rarefied Gas Dyn., Charlottesville, Va., 7 Jul. 1980
(Contract W-7405-eng-26)
(K/ET-5011-Rev-2; CONF-800715-1-Rev-2) Avail: NTIS

HC A02/MF A01

Classical theory predicts that forward scattering, as approximated by a fraction of specular reflections, has the same effect toward increasing both free molecule and slip flows. A recent model using backscattering predicts that backscattering has nearly the same effect toward decreasing both free molecule and slip flows. An analysis of experimental data is given which indicates that the effect is different for free molecule flow than for slip flow. An alternative calculation for the effect of both specular reflections and backscattering on free molecule flow is given. This calculation predicts a different effect for free molecule flow than for slip flow. The calculation also agrees somewhat better with the experimental data. DOE

N81-24399# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

ON CHARACTERISTIC STRUCTURES IN TIME FUNCTIONS FOR TURBULENT WALL PRESSURE FLUCTUATIONS [UEBER CHARAKTERISTISCHE STRUKTUREN IN ZEITFUNKTIONEN VON TURBULENTEN WANDDRUCKSCHWANKUNGEN]

Guenter Schewe Mar. 1980 31 p refs In GERMAN; ENGLISH summary

(MPIS-1/1980; ISSN-0436-1199) Avail: NTIS HC A03/MF A01

In the power spectrum of turbulent wall pressure fluctuations there are indications of the existence of Tollmein-Schlichting waves; these are substantiated by further measurements and by a more objective evaluation method. For the high frequency end of the spectrum, the mean frequency of the characteristic high amplitude pressure structures was determined by signal averaging. The influence of the pressure transducers, which are different in size and shape, on higher statistical moments is then simulated by combination of the signals of several small transducers on a computer. Results are used to evaluate the characteristic time function, and the probability of the established relationship between pressure gradients and time function being an aberration of experimental procedure is determined. Author (ESA)

N81-24400# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.

SOME CONSIDERATIONS ON THE PROPER CHOICE OF A NUMERICAL SCHEME FOR THE SOLUTION OF ONE DIMENSIONAL FLUID-DYNAMIC EQUATIONS

L. Brusa and L. Nigro Jun. 1980 16 p Presented at European Two-Phase Flow Group Meeting, Glasgow, 3-6 Jun. 1980 Sponsored by CNEN

(CISE-1587) Avail: NTIS HC A02/MF A01

The Evetep one dimensional fluid dynamic model was considered and the main features of the exact solution were investigated. As a result general guidelines for the choice of an efficient numerical procedure for the test problem solution are defined. These criteria are shown well-adapted to real problem analysis. The numerical scheme used in the RATT-1 code for the solution of fluid dynamic equations was evaluated theoretically. The analysis is confirmed by experimental computations.

Author (ESA)

N81-24401# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.

POST DRYOUT HEAT TRANSFER TESTS IN A TWO-SECTION HEATED TUBE

G. Barzoni, G. P. Gaspari, and R. Martini 1980 43 p refs Presented at European Two-Phase Flow Group Meeting, Glasgow, 3-6 Jun. 1980 Sponsored by NUCLITAL

(CISE-1593) Avail: NTIS HC A03/MF A01

Experiments were carried out on a 4 m length of Inconel tube as part of the boiling water reactor safety studies program. Once dryout was established at the end of the first tube section, steady state post dryout measurements were made at several heat flux values over the second tube section. Transient dryout recovery from prefixed post dryout conditions over the second tube section was achieved by step reduction of the heating power over the first section. It is shown that heat transfer coefficients are not affected by hysteresis. Data are compared with correlations. It is found that predictions from the Groeneveld-Delorme semi-empirical model are the most reliable.

Author (ESA)

N81-24402# Delft Hydraulics Lab. (Netherlands).

ROUND BUOYANT JET WITH THREE DIMENSIONAL TRAJECTORY IN AMBIENT FLOW

G. A. L. Delvigne Sep. 1980 11 p refs Presented at 18th IAHR Congr., Cagliari, Italy, Sep. 1979

(Publ-228) Avail: NTIS HC A02/MF A01

Differential equations were derived which described the three dimensional trajectory of the jet axis and the width and concentration along the trajectory of a jet. The jet discharges at arbitrary angle in an ambient flow that has a non-uniform velocity distribution as well as a nonhomogeneous density. This is an extension of the method for deriving the equations for a jet with a two dimensional trajectory in a medium with a uniform velocity field and a homogeneous density. Calculations agree well with measurements on jets with three dimensional trajectories from the literature. Author (ESA)

N81-24403# Delft Hydraulics Lab. (Netherlands). Waterloopkundig Lab.

ORBITAL VELOCITIES IN IRREGULAR WAVES

F. C. Vis Jun. 1980 15 p refs

(Publ-231) Avail: NTIS HC A02/MF A01

The applicability of linear wave theory for the description of the velocity field in irregular waves was studied, using laser velocimeter measurements made in a wave tank. A comparison between theory and measurement was made in the frequency domain by means of the experimentally and theoretically determined frequency response functions of wave motion to orbital velocity, and in time domain by means of the measured and computed time records of the velocities. The time records for the velocities were computed from the measured water level fluctuations by using the impulse response function method. Velocities near the free surface are found to match linear wave theory better than the velocities at mid-depth. For horizontal velocities, the trough velocities are greater in magnitude than crest velocities. Vertical velocities are distributed more symmetrically. Author (ESA)

N81-24404# Centre Technique des Industries Mecaniques, Senlis (France).

PRESENTATION AND COMMENTARY RELATIVE TO CODAP CALCULATION RULES FOR HEAT EXCHANGERS. THIRD AFIAP CONFERENCE PAPER Final Report [PRESENTATION COMMENTEE DES REGLES CODAP RELATIVES AUX ECHANGEURS DE CHALEUR POUR LE TROISIEME CONGRES AFIAP]

R. Osweiller 29 Oct. 1980 104 p refs In FRENCH Presented at 3rd AFIAP Congr. on Dimensionnement des Echangeurs de Chaleur a Plaques Tubulaires pour le Code Francais des Appareils a Pression, 1 Oct. 1980

(CETIM-R-45-070; Conf-Paper-3) Avail: NTIS HC A06/MF A01

The CODAP (French construction code for pressure apparatus) is introduced and supplement to the code concerning tube-sheet heat exchangers is proposed and discussed. Calculation hypotheses are explained, and innovations are pointed out by comparison with other construction codes. Dimensioning heat exchangers which incorporate U-shaped tubes and have floating endplates is treated. Exchangers with two fixed endplates are also covered. Theoretical and numerical comparisons with other standards highlight several differences. These concern: (1) the calculation of equivalent constants of elasticity in tube-sheets; (2) the calculation of exchanger dimensions in function of workload; (3) the inclusion of failure modes associated with excessive deformation, progressive deformation, and buckling; and (4) the determination of admissable stress in each part of the exchanger, using stress analysis. These design concepts are then formalized and given in a preliminary version of the CODAP supplement. Author (ESA)

N81-24405# Technische Hogeschool, Delft (Netherlands). Lab. for Aero and Hydrodynamics.

A GENERAL MODEL FOR UNCONFINED BUBBLE PLUMES FROM EXTENDED SOURCES

A. K. Chesters May 1980 40 p refs Submitted for publication

(WTHD-127) Avail: NTIS HC A03/MF A01

The upward flow produced by the continuous injection of

gas into a body of liquid is studied for the unconfined case, i.e., the width of the body of liquid is large in comparison with that of the plume and the pressure variation outside the plume is approximately hydrostatic. Plume equations are developed as to the form of the liquid velocity or gas fraction profiles, and for the proportion of the total momentum flux associated with the mean flow. The influence of injection geometry on initial and later plume development is investigated for extended sources (perforated disks or strips). The plume is predicted to undergo an initial contraction (confirmed experimentally). A second contraction is predicted near the surface of deep bodies of liquid. The theory is verified by local measurements of mean liquid velocity (laser-Doppler anemometry) and bubble velocity (double electrode method) in small plumes from axisymmetric extended sources. Author (ESA)

N81-24406# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

REGISTRATION AND UTILIZATION OF MEASUREMENT DATA WITH A MICROCOMPUTER DURING FLOW PHYSICS EXPERIMENTS [ERFASSUNG UND AUSWERTUNG VON MESSDATEN MIT EINEM KLEINRECHNER BEI STROEMUNGSPHYSIKALISCHEN EXPERIMENTEN]

Uwe Poerschke Jul. 1980 153 p refs In GERMAN; ENGLISH summary
(MPIS-11/1980; ISSN-0436-1199) Avail: NTIS HC A08/MF A01

The construction and experimental use of a cheap microcomputer system, based on a Commodore CBM 2001 computer, for data recording and analyzing is described. The computer hardware and software are extended. The additional hardware is built on cards and connected to the computer via a plug-in system. A direct memory access controller with FIFO buffer storage is used for high speed data transfer (more than 1 Mbyte/sec). Connecting transient recorders and multichannel data recording equipment is also possible. To increase the computing power, programs for signal averaging and Fourier transforms (FFT) were developed. The FFT program needs 10 to 12 sec for tranforming 1024 data points, each 16 bits wide. The experimental use of the complete system is demonstrated in a setup for measuring sound damping in ducts caused by flow rectifying structures. Altogether this computer system is an efficient tool which complements flow experiment techniques and at bearable expense. Author (ESA)

N81-24407# Stockholm Univ. (Sweden). Dept. of Meteorology.

ON THE NONLINEAR BEHAVIOR OF GRAVITY MODES IN AN EQUATORIAL BETA-PLANE SHALLOW WATER MODEL, WITH RESPECT TO LINEAR AND NONLINEAR NORMAL MODE INITIALIZATION

Stefan Gollvik Oct. 1980 37 p refs
(Contracts G-2923-100; G-UR-2923-101)
(DM-30) Avail: NTIS HC A03/MF A01

An equatorial beta plane shallow water model, written in normal-mode form, i.e., depending variables are amplitudes of the eigen solutions for the corresponding linear system, is used to examine the creation and nonlinear behavior of gravity modes. The results show that the shallower the fluid, the higher is the level of the gravity modes, created by the model, when initialized with linear normal mode conditions. Nonlinear normal mode initialization results in a somewhat lower level of the gravity modes, the difference being more pronounced when the fluid is shallow. An increase of the Rossby number has an effect similar to that of making the fluid more shallow. It is suggested that, for shallow fluids, the problem of solving the nonlinear system of equations, which appears in the case of nonlinear normal mode initialization, might depend on the fact that no solution exists. Author (ESA)

N81-24408# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Theoretische Stroemungsmechanik.

NUMERICAL TREATMENT OF PARABOLIC THREE DIMENSIONAL CASCADE FLOW. FLOW MODELING AND COMPUTATIONAL EXPERIMENTS

Roger Grundmann Aug. 1980 35 p refs
(DFVLR-FB-80-33) Avail: NTIS HC A03/MF A01

A method of solution for three dimensional cascade flow is illustrated. The flow is assumed laminar and incompressible. The governing equations consist of three equations of motion, an energy equation, and a continuity equation. The addition of the energy equation results in easier and numerically more stable handling by the proposed method of solution, and allows for eventual computation of compressible flows. As the calculation of reverse flow is not included, the governing equations are parabolized in the downstream direction. The downstream pressure gradient is iteratively corrected by permanent control of the overall mass flow. The choice of a nonorthogonal, curvilinear coordinate system makes it possible to accomodate different cascade contours. Author (ESA)

N81-24409# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Hardthausen (West Germany). Arbeitsgruppe Brennertechnologie.

DESCRIPTION OF A DROPLET SIZE DISTRIBUTION IN SPRAY FIELDS BY THE LIMITED LOGARITHMIC NORMAL DISTRIBUTION METHOD

Rolf Brandt, Michael Lindenthal, and Winfried Buschulte Jul. 1980 65 p refs In GERMAN; ENGLISH summary
(DFVLR-FB-80-23) Avail: NTIS HC A04/MF A01

The characterization of spray field droplets, using statistical mathematical models, is described. Specifically, the limited logarithmic normal distribution of drop diameter is calculated. The ramifications of including the Mugele-Evans exponent in computing the maximum drop size limite are emphasized. Measured drop size data, taken from various experiments with different sprayers, are compared with calculation. Good results for agreement with values for maximum drop size as well as mass-mean droplet diameter, and for confidence in the predicted distribution are shown. As an application, a FORTRAN program for the evaluation of experiments is given. Significant results for 85% of the cumulative volume of a sprayfield can be obtained. An iteration process for the conversion of mass-mean diameter into other mean diameters is also outlined. Author (ESA)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N81-24410 Stanford Univ., Calif.

A BIPOLAR-COMPATIBLE MONOLITHIC CAPACITIVE PRESSURE SENSOR Ph.D. Thesis

Craig Steven Sander 1981 156 p
Avail: Univ. Microfilms Order No. 8108987

Miniature capacitive pressure sensors are an alternative to other types of implantable pressure transducers and promise higher sensitivity and lower power consumption with possible reductions in temperature dependence and size. These claims are substantiated by the development of two monolithic capacitive absolute pressure sensors totally batch fabricated through integrated circuit technology. Theoretical derivation of the response of both of these capacitive sensors to pressure accurately models their behavior and demonstrates that, without sacrificing sensitivity, the minimum diaphragm size achievable is half as large as in piezoresistive transducers. The lowest possible limits on resolvable pressure, power consumption, and diaphragm size of a capacitive sensor with a period-modulated output have been established for any given circuit configuration and frequency response.
Dissert. Abstr.

N81-24411 Stanford Univ., Calif.

MODELING A CRYOGENIC HE3 NUCLEAR GYRO Ph.D. Thesis

Gerald Lawrence Shaw 1981 93 p
Avail: Univ. Microfilms Order No. 8108994

Several nonconventional gyro schemes were proposed.

Directed primarily at eliminating the bearing problems in conventional mechanical gyros, it was anticipated that either better performance could be achieved or performance comparable to conventional gyros could be achieved at a lower cost. Various aspects of a particular device, a cyrogenic HE sup 3 nuclear gyro, and to provide models for estimating its performance.
Dissert. Abstr.

N81-24412 Stanford Univ., Calif.
VERTICAL OPTIMIZATION PROCEDURE FOR AN INTEGRATED MICROPOWER SIGNAL PREPROCESSOR Ph.D. Thesis
Thomas Ray Harrison 1980 159 p
Avail: Univ. Microfilms Order No. 8108941

The need for low power operation is characteristic of all electronic measurement systems that transmit physiological data across the intact skin. Custom integrated circuits and hybrid microcircuit assembly techniques leave battery volume (or power drain) as the limiting factor for implanted-system lifetime and animal model size. First generation totally implantable Doppler blood flowmeters, telemeter Doppler-shifted signals having a 40 kHz bandwidth. External electronics are then used to convert this information into a flow signal with a maximum bandwidth of approximately 100 Hz. A vertically optimized system circuit device procedure utilizes a digital data link for telemetry to reduce flowmeter transmitter power consumption. In this CW Doppler ultrasonic flowmeter, a potential 400:1 reduction in FM transmitter power is possible through additional signal preprocessing in the implanted package. A 10:1 savings in transmitter power drain is realized by a novel preprocessor developed to encode and telemeter pulsed digital data rather than Doppler signals. Author

N81-24413*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD AND APPARATUS FOR SUPERCOOLING AND SOLIDIFYING SUBSTANCES Patent Application
Lewis L. Lacy, Michael B. Robinson, Thomas J. Rathz, Lester Katz, and Daniel B. Nisen, inventors (to NASA) Filed 23 Mar. 1981 20 p
(NASA-Case-MFS-25242-1; US-Patent-Appl-SN-246773) Avail: NTIS HC A02/MF A01 CSCL 14B

The containerless melting, supercooling, and solidification of substances is facilitated by using an enclosure in which the specimen is positioned, maintained at ground potential, and suspended by a support wire made of the major constituent of the sample. A melting apparatus in the enclosure has a hot circular cathode for supplying bombarding electrons and a focusing grid for concentrating the electrons on the sample surface. An elongated drop tube aligned with the specimen is disposed under the enclosure, and vacuum sources are provided for evacuating the enclosure and drop tube. A detachable specimen catcher adjacent to the bottom of the drop tube recovers the specimen. The method involves heating the specimen, dropping the specimen melt through the tube where it cools by radiation, and recovering the resolidified specimen. The tube may be filled with an inert gas so that the specimen cools by convection as well as radiation. During free fall of the molten material, the sample is in a containerless, low gravity environment which enhances supercooling. Nucleation in the falling specimen is sensed by silicon photovoltaic detectors, and the amount of supercooling is determined from nucleation time and cooling rate. NASA

N81-24414*# National Aeronautics and Space Administration. Pasadena Office, Calif.
MOBILE SAMPLER FOR USE IN ACQUIRING SAMPLES OF TERRESTRIAL ATMOSPHERIC GASSES Patent Application
Curtis E. Tucker, Jr. (JPL) and Harold P. Holway, inventor (to NASA) (JPL) Filed 23 Mar. 1981 15 p
(Contract NAS7-100)
(NASA-Case-NPO-15220-1; US-Patent-Appl-SN-246777) Avail: NTIS HC A02/MF A01 CSCL 14B

Samples of terrestial atmospheric gasses may be acquired from a free body of such gasses using a device which is characterized by a number of tubular bodies adapted to be mounted in side-by-side relation on a motorized highway vehicle in mutual parallelism with the axis of the normal path of travel for the vehicles. Each of the bodies is of a cylindrical configuration and has an axial opening at each of its opposite ends through which a linear flow path is defined. A pair of pivotally supported, spring-biased sealing caps is mounted adjacent to the ends of the body and continuously urged into a hermetic sealing relationship. A restraint for securing the caps against spring-urged pivotal displacement, includes a separable, normally tensioned line interconnecting the caps and an operable release mechanism for simultaneously releasing the caps for spring-urged displacement. A hot wire cutter is included for separating the line, whereby samples of air are trapped in the body as the caps are spring-driven to assume a hermetically sealed relation with the openings defined in each of the opposite ends of the body. NASA

N81-24415*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HOLOGRAPHIC FLOW VISUALIZATION AT THE LANGLEY EXPANSION TUBE
William K. Goad and Alpheus W. Burner Jun. 1981 25 p refs
(NASA-TM-83116; L-14410) Avail: NTIS HC A02/MF A01 CSCL 14E

A holographic system used for flow visualization at the Langley Expansion Tube is described. A ruby laser which can be singly or doubly pulsed during the short run time of less than 300 microns is used as the light source. With holography, sensitivity adjustments can be optimized after a run instead of before a run as with conventional flow visualization techniques. This results in an increased reliability of the flow visualization available for the study of real-gas effects on flow about models. Holographic techniques such as single-plate schlieren and shadowgraph, two plate interferometry, double pulse interferometry for perfect infinite-fringe interferograms, and double-pulse interferometry used to examine changes in the flow over a short time period are described and examples presented.
Author

N81-24416*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMBINED SINGLE-PULSE HOLOGRAPHY AND TIME-RESOLVED LASER SCHLIEREN FOR FLOW VISUALIZATION
A. W. Burner and W. K. Goad Jun. 1981 16 p refs
(NASA-TM-83109; L-14397) Avail: NTIS HC A02/MF A01 CSCL 14E

A pulsed ruby laser and continuous-wave argon ion laser were used in a combined setup at the Langley Expansion Tube for single pulse holography and time resolved laser schlieren with a common optical axis. The systems can be operated simultaneously for a single run. For a single frame, the pulsed holographic setup offers the options of shadowgraph, Schlieren, and interferometry from the reconstructed hologram as well as the advantage of post-run sensitivity adjustments. For flow establishment studies the time resolved laser Schlieren provides visualization of the flow field every 12.5 microns for up to 80 frames with an exposure time per frame of 5.4 microns.
Author

N81-24417# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
DEVELOPMENT OF A MEASUREMENT SYSTEM FOR A LIQUID HELIUM-COOLED MICHELSON INTERFEROMETER ON SPACELAB [ENTWICKLUNG EINES VORSCHUBMESSSYSTEMS FUER EIN HELIUMGEKUEHLTES MICHELSONINTERFEROMETER AUF SPACELAB]
Peter Essenwanger Jan. 1980 92 p refs In GERMAN
(MPI-PAE/Extraterr-161; ISSN-0340-8922) Avail: NTIS HC A05/MF A01

An experimental thrust measuring system for the helium cooled spectral high solvent Michelson interferometer was built and tested. The purpose of the project was to derive and prove experimentally the component's (diode lasers, detectors, radiation particles) work criteria. Results show that thrust measurements of the examined components was 0.06 mcm. At the same time a thrust measuring system of higher analysis was established which is important in satellites in use under cryogenic conditions. Transl. by E.A.K.

N81-24418# Artec Associates, Inc., Hayward, Calif.
THERMAL NOISE EMISSIONS FROM A HOT GAS Final Report
Dennis W. Baum, Stephen P. Gill, W. Lee Shimmin, and John D. Watson Mar. 1981 35 p refs
(Contract N00014-80-C-0529)
(AD-A098086; FR-153) Avail: NTIS HC A03/MF A01 CSCL 14/2

This report describes experiments to measure thermal noise emissions from hot wire and hot gas conductors. A simple analysis of these measurements is developed to relate the thermal noise power to the thermodynamically correct temperature of the hot conductor. We conclude that the absolute temperature of the conductors can be measured to an accuracy of 1%. The results of this work suggest that nonintrusive transient temperature measurements can be made in the interior of combustion processes. GRA

N81-24419# Sandia Labs., Albuquerque, N. Mex.
TANDEM PRESSURE MEASUREMENTS IN A HOSTILE ENVIRONMENT
P. B. Higgins 1981 16 p refs Presented at the 27th Intern. Instr. Symp., Indianapolis, 27 Apr. 1981
(Contract DE-AC04-76DP-00789)
(SAND-81-0442C; CONF-810406-3) Avail: NTIS HC A02/MF A01

Both carbon gages and quartz gages were calibrated with gas guns utilizing thin flyers. Experiments are described which compare the response of the two types of gages to a nonplaner stress pulse generated by the detonation of an explosive, silver acetylide-silver nitrate. It was concluded from 18 pairs of gages tested at three impulse levels that detonation of the explosive at no less than 100 points square cm would produce equal peak stress currents from the two types of gages within 25 percent. Impulse derived by integrating the pressure time profile from the carbon gages mounted on quartz gages did not agree with ballistic pendulum impulse data, possibly because of early cracking of quartz beneath the carbon gage. However, similar integration of the pressure profile of carbon gages mounted on flat aluminum, extrapolated for long times along a theoretical curve, gave an impulse practically equal to the directly measured impulse. DOE

N81-24420# Agfa-Gevaert A.G., Munich (West Germany). Camera-Werk.
AUTOMATIC FOCUSING DEVICES FOR PHOTOGRAPHIC CAMERAS Final Report
Klaus Birgmeier and August Hell Bonn Bundesministerium fuer Forschung und Technologie Sep. 1980 112 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-103; ISSN-0340-7608) Avail: NTIS HC A06/MF A01

Automatic focusing systems for either still or movie cameras are defined. System requirements, depending on camera characteristics (aperture), lighting conditions or the use of high-speed color film, are identified. Passive and active systems are considered. Optimizing rules are derived for passive systems. Two functioning models were built, using modified cameras: one incorporating contrast measuring, the other, autocorrelation based on image scanning. Working models of active systems which measure distance as a focusing criterion were also constructed. Triangulation with IR optics, and time delay measurement of ultrasonic signals were tried. The various systems were evaluated for ultimate range, focusing quality, and time needed for accurate measurements. The practicability of both passive and active systems is demonstrated. However, electronic and optical complexity must be traded off against focusing requirements in choosing a suitable camera system. Author (ESA)

N81-24421# Technical Research Centre of Finland, Espoo. Reactor Laboratory.
ASTACUS. A REVERSE NEUTRON TIME OF FLIGHT DIFFRACTOMETER USING A FOURIER CHOPPER
Antero Tiitta 1980 56 p refs
(VTT-ENT-27; ISSN-951-38-0976-5) Avail: NTIS HC A04/MF A01

A neutron diffractometer based on the reverse Fourier time of flight method and intended for the study of powdered samples is described. The Fourier chopper attains a maximum modulation frequency of 120 kHz, allowing a time resolution of about 10 microsec, depending on the frequency window employed. In the geometry, the time focusing principle is used to obtain high resolution. The lattice plane distances are resolved with a precision of Delta d/d = 0.32% at d = 1 A and Delta d/d = 0.16% at 3.0 A. The diffractometer facility, its computer data acquisition hardware as well as the programs developed for controlling measurement and for acquiring and storing data are detailed. The performance of the facility was tested on a nickel powder sample, and the results of the profile refinement procedure for the measured diffraction patterns are given. The accuracy obtained for the lattice parameter determination is to 0.0001, and the room temperature value obtained for the Debye-Waller coefficient of nickel is B sub Ni = 0.425 (+ or - 0.065) A squared. Author (ESA)

36 LASERS AND MASERS

Includes parametric amplifiers.

N81-24422* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DIRECTION SENSITIVE LASER VELOCIMETER
John M. Franke, inventor (to NASA) 10 Mar. 1981 5 p Filed 6 Apr. 1979 Supersedes N79-28532 (17 - 19. p 2550)
(NASA-Case-LAR-12177-1; US-Patent-4,255,048; US-Patent-Appl-SN-027558; US-Patent-Class-356-28.5; US-Patent-Class-356-356; US-Patent-Class-356-358;) Avail: US Patent and Trademark Office CSCL 20E

A laser velocimeter is described which determines the direction of movement of particles. A laser produces a transmitted beam that illuminates the volume under investigation. The backscattered light is divided into two equal intensity beams. A first part of a sample of the transmitted beam is mixed with one of the two equal intensity beams and applied to a first photodetector. A second part of the sample is phase shifted by 90 deg, mixed with the other of the two equal intensity beams and applied to a second photodetector. The output of the first photodetector is phase shifted by 90 deg and then multiplied with the output of the second photodetector to produce a signal indicative of direction of movement.

Official Gazette of the U.S. Patent and Trademark Office

N81-24423 Stanford Univ., Calif.
FREQUENCY AND MODE CONTROL OF Q-SWITCHED Nd:YAG LASERS Ph.D. Thesis
Yong Kwan Park 1981 113 p
Avail: Univ. Microfilms Order No. 8108975

Two experimental studies are presented which extend the usefulness of Q-switched Nd:YAG lasers in nonlinear optical and spectroscopic applications. A transient injection locking theory is developed which describes single axial mode selection in Q-switched or gain switched laser oscillators. Comparison is made with experiments carried out for an unstable resonator Q-switched Nd:YAG oscillator. Growth procedures of high phasematching temperature lithium niobate crystals are investigated for various concentration of excessive lithium oxide and co-doped magnesium oxide in melt composition and for various growth parameters.

Dissert. Abstr.

N81-24424 Stanford Univ., Calif.
EXCITED STATE SPECTROSCOPY ON HELIUM USING A COLOR CENTER LASER Ph.D. Thesis
Deborah Jean Jackson 1981 112 p
Avail: Univ. Microfilms Order No. 8108950

The recent application of optogalvanic detection for observing weak transitions in the visible was adapted to infrared spectroscopy. For Doppler limited spectroscopy, infrared optogalvanic detection has proven particularly sensitive to those states which the highest angular quantum number; and the observed signal strengths are in good agreement with a steady state model of the optogalvanic effect in the helium positive column. Doppler free optogalvanic spectra were also studied. Holtzmark broadening of the helium linewidth makes it difficult to retrieve spectros-

copic information on the fine structure intervals from spectra taken in a discharge; on the other hand, potentially useful information on the processes of the discharge can be extracted from the linewidths and signal strengths. Dissert. Abstr.

N81-24425*# National Aeronautics and Space Administration. Pasadena Office, Calif.
MASER AMPLIFIER SLOW WAVE STRUCTURE Patent Application
Robert C. Clauss (JPL), Rex B. Quinn (JPL), Samuel M. Petty (JPL), and David L. Trowbridge, inventors (to NASA) (JPL) Filed 23 Mar. 1981 14 p
(Contract NAS7-100)
(NASA-Case-NPO-15211-1; US-Patent-Appl-SN-246779) Avail: NTIS HC A02/MF A01 CSCL 20E

A maser amplifier is described which includes a slow wave structure having multiple comb elements lying against a strip of maser material, which is constructed to avoid problems arising from differential expansion of the materials of the maser strip and comb during temperature cycling, and that enables formation and mounting of the comb elements by the relatively precise and low cost printed circuit techniques. Each comb has a height of about one half wavelength of the microwaves to be amplified, and the comb elements are devoid of direct electrical connections to one another or to the waveguide walls. The comb elements can be formed by vapor deposition, plating, or etching of an adhesively mounted foil, on a dielectric backing strip. NASA

N81-24426*# National Aeronautics and Space Administration. Pasadena Office, Calif.
RESONANT ISOLATOR FOR MASER AMPLIFIER
Robert C. Clauss, inventor (to NASA) (JPL) 23 Mar. 1981 15 p
(Contract NAS7-100)
(NASA-Case-NPO-15201-1; US-Patent-Appl-SN-246778) Avail: NTIS HC A02/MF A01 CSCL 20E

An isolator is described for use in a low-noise maser amplifier, which provides low loss across a wide bandwidth and which can be constructed at moderate cost. The isolator includes a train of garnet or ferrite element extending along the length of a microwave channel parallel to the slow-wave structure with the elements being of staggered height, so that the thin elements which are resonant to the microwaves are separated by much thicker elements. The thick garnet or ferrite elements reduce the magnetic flux passing through the thin elements to permit altering of the shape of the thin elements so as to facilitate their fabrication and to provide better isolation with reduced loss, by increasing the thickness of the thin elements and decreasing their length and width. NASA

N81-24427*# Laser Development Corp., Lexington, Mass.
PHOTOEXCITATION OF LASERS AND CHEMICAL REACTIONS FOR NASA MISSIONS: A THEORETICAL STUDY Final Report, 15 Dec. 1976 - 17 Dec. 1977
A. Javan and M. Guerra May 1981 50 p refs
(Contract NAS1-14688)
(NASA-CR-3428) Avail: NTIS HC A03/MF A01 CSCL 20E

The possibility of obtaining CW laser oscillation by optical pumping in the infrared at an elevated gas pressure is reviewed. A specific example utilizing a mixture of CO and NO gases is included. The gas pressures considered are in excess of several atmospheres. Laser frequency tuning over a broad region becomes possible at such elevated gas pressures due to collisional broadening of the amplifying transitions. The prior-rate and surprisal analysis are applied to obtain detailed VV and VT rates for CO and NO molecules and the transfer rates in a CO-NO gas mixture. The analysis is capable of giving temperature dependence of the rate constants. Computer estimates of the rates are presented for vibrational levels up to v = 50. The results show that in the high-lying vibrational states the VV transfer rates with Delta nu = 2 become appreciable. R.C.T.

N81-24428# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
STUDIES OF BEAM EXPANSION AND DISTRIBUTED BRAGG REFLECTOR LASERS FOR FIBER OPTICS AND OPTICAL SIGNAL PROCESSING Interim Report
Elsa M. Garmire 3 Mar. 1981 47 p refs
(Contract F04701-80-C-0081)
(AD-A097978; TR-0081(6930-03)-1; SD-TR-81-18) Avail: NTIS HC A03/MF A01 CSCL 20/5

Separate studies were performed on beam expansion and on distributed Bragg Reflector (DBR) lasers preliminary to monolithic integration on GaAs substrates. These components are proposed for use in optical signal processing, for fiber optic sources and for high brightness lasers. GRA

N81-24429# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.
SUMMARY OF THE AEROSPACE CORPORATION CHEMICAL LASER PROGRAM, 1968 - 1980 Interim Report
Walter R. Warren, Jr. Apr. 1980 58 p refs
(Contract F04701-80-C-0081)
(AD-A097979; TR-0081(6606)-1; SD-TR-81-14) Avail: NTIS HC A04/MF A01 CSCL 20/5

The applied research work since 1968 of Aerophysics Laboratory personnel in high energy laser related technology areas is summarized. The results are primarily concerned with hydrogen halide chemical lasers. The eight principal technology areas identified are hydrogen halide chemical kinetics (neutrals), pulsed hydrogen fluoride, HF (and deuterium fluoride, DF) lasers, fluid dynamics 'CW HF (DF) supersonic diffusion lasers, laser device optics, short wavelength lasers, diagnostics' instrumentation/test techniques, and special studies; several subdivisions are given for each area. A comprehensive bibliography and a list of laser related inventions are presented; these are cross referenced to the technology areas and their subdivisions. The experimental and computer capabilities of the Laboratory are described briefly. GRA

N81-24430# Naval Research Lab., Washington, D. C.
SIMULATION OF LASER BEAM NONUNIFORMITY EFFECTS
M. H. Emery, J. H. Orens, J. H. Gardner, and J. P. Boris 24 Apr. 1981 23 p refs
(AD-A097991; NRL-MR-4500) Avail: NTIS HC A02/MF A01 CSCL 20/8

We investigate the effect of a nonuniform beam on the ablative acceleration of thin foils using the FAST2D laser shell simulation code. The results show that laser nonuniformities with scalelengths greater than the distance from the ablation surface to the critical surface would have a severe impact on drive pressure symmetry and hence on pellet gain. GRA

N81-24431# Naval Research Lab., Washington, D. C. Plasma Theory Branch.
CALCULATIONS OF BRILLOUIN BACKSCATTER IN LASER-PRODUCED PLASMAS
W. M. Manheimer and D. G. Colombant 24 Apr. 1981 34 p refs
(AD-A098045; NRL-MR-4503) Avail: NTIS HC A03/MF A01 CSCL 20/9

Brillouin backscatter is calculated in an inhomogeneous laser produced plasma. Equations for the spatial dependence of the incident reflected and sound wave are numerically integrated through the underdense plasma. Effects investigated are the stabilizing effects of ion heating or nonlinear sound wave dissipation, flow velocity magnitude and gradient, electron heating and broad band incident laser light. We find that the effect of velocity gradient and broad band light can be very important in reducing the backscatter. Author (GRA)

N81-24432# Naval Research Lab., Washington, D. C.
A NUMERICAL STUDY OF THE NANOSECOND AND SUBNANOSECOND PERFORMANCE OF GEKKO-XII-MODULE Interim Report
R. H. Lehmberg and J. M. McMahon 23 Apr. 1981 29 p refs
(AD-A098080; NRL-MR-4493) Avail: NTIS HC A03/MF A01 CSCL 20/5

A numerical study is conducted to examine the performance potential of the GEKKO XII-Module, a phosphate glass laser system currently under development at Osaka University. The study shows that with appropriate modifications, this system should produce peak powers up to 3.6 TW/beam in a 50 psec pulse, and 2-2.5 kJ/beam in a 1 nsec pulse. The similarity

between the GEKKO XII-Module and Shiva beam line configurations suggests that a phosphate glass retrofit of Shiva could produce nanosecond pulse energies up to 50 kJ. Author (GRA)

N81-24433# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.

AMPLIFICATION IN DOUBLE HETEROSTRUCTURE GaAs LASERS Interim Report

Elsa M. Garmire and Michael Chang 15 Mar. 1981 46 p refs

(Contract F04701-80-C-0081)

(AD-A097862; TR-0081(6930-03)-2; SD-TR-81-30) Avail: NTIS HC A03/MF A01 CSCL 20/5

Regenerative amplification has been measured in a DH GaAs laser in two different geometries, including both discrete and integrated optics configurations. Regimes of strong and weak signal gains have been identified and measured, with gains being as large as 170. Comparison has been made between the experimental results and theoretical models. In general, the agreement is excellent. Details of the experiments and theoretical models are presented in this report. Author (GRA)

N81-24434# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.

PROGRESS TOWARD A MONOLITHICALLY INTEGRATED COHERENT DIODE LASER ARRAY Interim Report

Gary A. Evans, Elsa M. Garmire, Harold M. Stoll, Judith A. Osmer, William E. Soady, Allen B. Lee, and Myron P. Ziegler 20 Feb. 1981 210 p refs

(Contract F04701-80-C-0081)

(AD-A097899; TR-0081(6930-04)-2; SD-TR-81-7) Avail: NTIS HC A10/MF A01 CSCL 20/5

Progress toward the design and fabrication of a GaAlAs semiconductor laser array capable of high average power levels (0.1 to 1.0 watt) and low (approx 1 millirad) beam divergence is reported. A large optical cavity (LOC) configuration is grown by liquid phase epitaxy. The LOC structure is characterized by photoluminescence scans, ion microprobe mass analysis (IMMA), and optical waveguiding measurements. Fabry-Perot, active-passive, and DBR lasers are fabricated using chemical and ion beam etching. Gratings formed using holographic and ion beam etching techniques provide third order feedback for the DBR lasers, and are also used as distributed beam deflectors (DBDs) and output couplers. Comparisons of the results of experiments performed on DBR lasers, DBDs, and coupled lasers are made with theoretical models. Details of the material growth, material characterization, device fabrication, experiments, and theoretical models are presented in this report. Author (GRA)

N81-24435# Science Applications, Inc., Boulder, Colo. Plasma Research Inst.

FREE ELECTRON LASER INSTABILITY FOR A RELATIVISTIC ANNULAR ELECTRON BEAM IN A HELICAL WIGGLER FIELD

Han S. Uhm and Ronald C. Davidson Nov. 1980 42 p refs Prepared in cooperation with MIT, Cambridge

(Contract N00014-79-C-0555)

(AD-A098241; SAI-254-80-626-LJ; PRI-17) Avail: NTIS HC A03/MF A01 CSCL 20/5

The free electron laser instability is investigated for a relativistic annular electron beam propagating through a helical wiggler magnetic field. It is assumed that the beam is thin, with radial thickness (2a) much smaller than the beam radius (RO), and that nu/gamma(b) -- 1, where nu is Budker's parameter. The stability analysis is carried out within the framework of the harmonic number 1 and radial mode number s, including the important influence of (1) finite beam geometry in the radial direction, (2) positioning of the beam radius relative to the outer conducting wall (RO/Rc), and (3) finite wiggler amplitude (deta B). All of these effects are shown to have an important influence on stability behavior. Moreover, the maximum coupling between the transverse and longitudinal modes increases substantially with increasing radial mode number s. It is also found that the transverse magnetic (TM) mode has slightly larger growth rate than the transverse electric (TE) mode. GRA

N81-24436# California Univ., Livermore. Lawrence Livermore Lab.

FREE ELECTRON LASER AS A FUSION DRIVER

D. Prosnitz and L. Schlitt 1981 10 p refs Presented at Soc. of Photo-opt. Instrumentation Engr. Los Angeles Tech. Symp., North Hollywood, Calif., 9-13 Feb. 1981 Submitted for Publication

(Contract W-7405-eng-48)

(UCRL-85026) Avail: NTIS HC A02/MF A01

The free electron laser (FEL) is shown to be a potentially attractive solution to the problem of finding a suitable short wavelength fusion driver. The design of a 3 MJ, 250 nm FEL fusion driver is discussed. DOE

N81-24437# Los Alamos Scientific Lab., N. Mex.

NEW APPROACH TO FUSION-LASER OPTICAL PULSE GENERATION HAS PROVEN VERY RELIABLE

R. L. Carman, F. Wittman, and N. Clabo 1980 7 p refs Presented at Society for Opt. and Quantum Electronics Conf., McLean, Va., Dec. 1980

(Contract W-7405-eng-36)

(LA-UR-81-0049; CONF-801243-1) Avail: NTIS HC A02/MF A01

Starting with 6 CW frequency stabilized CO2 oscillators, 1 ns pulses were generated with any combination of six rotational-vibrational lines selected from both the P- and R-branches, and the 9 micrometer and 10 micrometer bands. Total output power > 100 KW was obtained with excellent reproducibility in both the total power as well as the ratios of the powers in the six rotational-vibrational lines. This capability represents a potential starting point for temporal pulse programming of the output of a large CO2 amplifier chain. DOE

N81-24438# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.

RESEARCH PROGRAMS IN ITALY ON HIGH POWER LASERS AND THEIR APPLICATIONS TO METAL WORKING

A. Sona (CNR) 1980 8 p refs Presented at Intern. Conf. in Welding Res. in the 1980'8, Osaka, 27-29 Oct. 1980 Sponsored by CNR's Special Project on Lasers

(CISE-1636) Avail: NTIS HC A02/MF A01

Three types of CO2 laser sources are compared: fast axial flow, transverse excitation with sectioned discharge, and transverse excitation with electron beam excitation. High average power Nd/YAG lasers (up to 400 W) are considered developed as alternative sources when shorter wavelengths are required. Mathematical models in connection with detailed experimental tests are included in the research programs. The problems dealing with reliability, efficiency and focusing of the various kind of laser sources for welding drilling, cutting, cladding, heat treatment, and surface alloying are discussed. Author (ESA)

N81-24439# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.

MEASUREMENTS ON A TRANSVERSE FLOW, SECTIONED DISCHARGE, CONTINUOUS WAVE CO2 LASER PROTOTYPE [MISURE EFFETTUATE SU UN PROTOTIPO DI LASER A CO2 IN CONTINUA A FLUSSO TRASVERSO E SCARICA SEZIONATA]

V. Donati, V. Fantini, and G. Incerti 1980 11 p refs In ITALIAN Presented at 2nd Natl. Congr. of Quantum and Plasma Electron., Palermo, Italy, 22-11 May 1980

(Contract CNR-79-01579.98)

(CISE-1644) Avail: NTIS HC A02/MF A01

The optimization of the mix composition and electrooptical efficiency in a CO2 CW laser prototype was investigated. The configuration of the exciting electrodes allows for the control of the profile of the discharge current in two orthogonal directions by adjustment of ballast resistors. Measurements of the small signal gain were performed to study the space and time dependence. The system stability in function of various parameters was also studied. By using a mix (CO2 : N2 : He of 2 : 13 : 35 torr) 1KW of output optical power is achieved with an electrooptical efficiency of 10%. Author (ESA)

N81-24440# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.

ADJUSTABLE SOURCE FOR WAVELENGTHS FROM 4 TO 10 MICRONS USING GaSe AND AgGaSe2 CRYSTALS

[SORGENTE ACCORDABILE DA 4 A 10 MICROMETERS GON CRISTALLI DI GaSe ED AgGaSe2]
A. Bianchi, M. Garbi, and A. Ferrario 1980 13 p refs In ITALIAN Presented at 2nd Natl. Congr. on Quantum and Plasma Electron., Palermo, Italy, 20-22 May 1980
(Contract CNR-78-02616.11)
(CISE-1646) Avail: NTIS HC A02/MF A01

An adjustable laser source was developed for shorter wavelengths than those attainable using CdSe crystals. The experimental device is composed of a Nd-YAG laser, an optical isolator, an amplifier, a LiNbO3 optical parametric oscillator, and GaSe or AgGaSe2 crystals as nonlinear materials. Experimental data showing phase matching angles and power output in function of the wavelength are presented. It is concluded that both crystals are efficient in application as adjustable sources of 4 to 10 micron radiation. Author (ESA)

N81-24441# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.
CONCENTRATION AND TEMPERATURE MEASUREMENTS IN COMBUSTION MEASUREMENTS USING COHERENT ANTISTOKES RAMAN SCATTERING (CARS) SPECTROSCOPY [MISURE DI CONCENTRAZIONI E TEMPARATURE IN ATMOSFERE DI COMBUSTIONE MEDIANTE SPETTROSCOPIA CARS (COHERENT ANTISTOKES RAMAN SCATTERING)]
C. Malvicini 1980 16 p refs In ITALIAN Presented at 2nd Natl. Congr. on Quantum and Plasma Electron., Palermo, Italy, 20-22 May 1980
(Contract CSM/CISE-APP/39298)
(CISE-1647) Avail: NTIS HC A02/MF A01

The principles of coherent antiStokes Raman scattering CARS spectroscopy are reviewed and measurement results for the spectra of typical combustion gases in cells heated to 1800 K are described. These measurements serve to obtain reference data from controlled atmospheres. The experimental device is based on the use of a Nd-YAG laser, a Q switch, two amplifiers and a dye laser assembled for wideband operation in order to select the band necessary for each molecule. Author (ESA)

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N81-24442* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SELF-STABILIZING RADIAL FACE SEAL Patent
Izhak Etsion, inventor (to NASA) (Technion Research and Development Foundation Ltd., Haifa, Israel) Issued 7 Jan. 1981 6 p Filed 17 Nov. 1978 Supersedes N79-12445 (17 - 03, p 0333) Sponsored by NASA
(NASA-Case-LEW-12991-1; US-Patent-4,260,166; US-Patent-Appl-SN-961-832; US-Patent-Class-277-96;) Avail: US Patent and Trademark Office CSCL 11A

A self-stabilizing radial face seal comprises an axial member and a primary seal ring juxtapositioned to a seal seat. At least one primary seal ring and seal seat unit is affixed to the axial member so as to rotate with it. The primary seal ring has a front face which opposes a face of the seal seat. The seal has both high-pressure and low-pressure regions of fluid, and seal seat is provided with a porous ring-like circumferential structure in the face of the seal seat opposite the front face of the primary seal ring.
Official Gazette of the U.S. Patent and Trademark Office

N81-24443* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TIRE/WHEEL CONCEPT Patent
Philip M. Harper, Sr., inventor (to NASA) (Boeing Commercial Airplane Co., Seattle) Issued 19 May 1981 6 p Filed 12 Dec. 1979 Continuation of abandoned US Patent Appl. SN-893865, filed 16 Apr. 1978 Sponsored by NASA
(NASA-Case-LAR-11695-2; US-Patent-4,267,992; US-Patent-Appl-SN-103836; US-Patent-Class-244-103R; US-Patent-Class-152-330RF; US-Patent-Class-152-353R; US-Patent-Class-152-353G; US-Patent-Class-152-379.4; US-Patent-Class-244-130; US-Patent-Appl-SN-893865) Avail: US Patent and Trademark Office CSCL 13F

A tire and wheel assembly is disclosed in which a low profile pneumatic tire (having sidewalls which deflect inwardly under load) and a wheel (having a rim featuring a narrow central channel and extended rim flanges) form the combination. The extended rim flanges support the tire sidewalls under static and dynamic loading conditions to produce a combination particularly suited to aircraft applications.
Official Gazette of the U.S. Patent and Trademark Office

N81-24444 Illinois Univ. at Urbana-Champaign.
STUDIES ON THE MOTION OF CONTINUOUS VISCOELASTIC ROTORS Ph.D. Thesis
Robert Lee Norwood 1980 147 p
Avail: Univ. Microfilms Order No. 8108616

This analytical investigation of continuous viscoelastic rotor motion is based upon undeformed rotor geometry being that of a right circular cylindrical shaft. The derivation of the motion equations for this Euler beam rotating shaft utilize the work energy approach. It is assumed that constant torque is applied at the shaft ends which are fixed in long ideal bearings. The derived field equations are three coupled, higher order, linear, partial differential equations. The coupling is effected through the shaft unbalance forcing terms. Both coupled and uncoupled motion is considered. The uncoupled steady state motion analysis includes single mode expansion with internal and external damping. The uncoupled nonsteady state motion analysis concerns an initially bent shaft returning to a straight configuration under deceleration with external damping. The coupled steady state motion analysis investigates the effect of various mass unbalance position vectors on the torsion coordinate. Dissert. Abstr.

N81-24445*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
A GAS-TO-HYDRAULIC POWER CONVERTER Patent Application
Charles Wesley Galloway, inventor (to NASA) Filed 27 Feb. 1981 13 p
(NASA-Case-MSC-18794-1; US-Patent-Appl-SN-238785) Avail: NTIS HC A02/MF A01 CSCL 13I

A gas piston driven hydraulic piston pump with a high efficiency gas cycle which injects the gas in slugs at the beginning of each power stroke is discussed. The hydraulic piston is disposed to operate inside the gas piston, and the two pistons which are both slidably but nonrotably mounted, are coupled together with a rotating but nonsliding motion transfer ring extending into antifriction grooves in the sidewalls of the two pistons. To make the hydraulic piston move at a constant speed during constant hydraulic horsepower demand, grooves are machined with variable and opposite pitches. The motion transfer ring is denominated a force multiplier ring. It is concluded that any number of piston assembly sets may be used to obtain desired hydraulic horsepower. NASA

N81-24446*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APPARATUS FOR ACCURATELY PRELOADING AUGER ATTACHMENT MEANS FOR FRANGIBLE PROTECTIVE MATERIAL Patent Application
Kenneth E. Wood, inventor (to NASA) (Rockwell International Corp., Downey, Calif.) Filed 30 Mar. 1981 12 p Sponsored by NASA
(NASA-Case-MSC-18791-1; US-Patent-Appl-SN-248746) Avail: NTIS HC A02/MF A01 CSCL 13I

Improvements to accurately adjust and secure the preload on the spring means, which were used on the Space Shuttle Orbiter, are discussed. Two forms of the tool are described; a multipart tool and a mounting jig. A known preload is applied to the spring means utilized for resiliently attaching frangible protective tile to the surface of structures which are exposed to extremely high temperatures. The tool is adaptable for applying preloads to devices installed in blind holes. NASA

N81-24447*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

VARIABLE SPEED DRIVE Patent Application
Henry D. Obler, inventor (to NASA) Filed 27 Feb. 1981 12 p
(NASA-Case-GSC-12643-1; US-Patent-Appl-SN-238786) Avail: NTIS HC A02/MF A01 CSCL 13I

A variable speed drive is described wherein a first embodiment is comprised of a pivotally mounted prime mover coupled to a rotary fluid output device, such as a fan or pump, through a variable and fixed pulley drive arrangement. The pivotal position of the prime mover and accordingly the pitch diameter of variable pulley means is controlled in accordance with fluid motor means coupled to the prime mover. This is actuated in response to a fluid feedback control signal derived from a sensed output of the rotary fluid output device. The pivotal motion of the prime mover imparts an accurate motion to the variable pulley means which effects a speed variation of the rotary fluid output device in accordance with the variation of the pitch diameter ratio of opposing variable and fixed pulley means. In a second embodiment, idler pulley means are pivotally mounted between the prime mover and the rotary fluid output device. NASA

N81-24448*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
LARGE PLATFORM ASSEMBLER NON-STRUCTURAL SYSTEM REQUIREMENTS Final Report
Robert M. Vernon Apr. 1981 81 p refs
(Contract NAS1-15240)
(NASA-CR-165681; LMSC/D760269) Avail: NTIS HC A05/MF A01 CSCL 22B

The impact on the design and operation of an automated structure assembler of requiring the assembler to also install the platform electrical and/or fluid utility circuits was examined. Possible utility requirements were defined and examined in conjunction with the automated assembler. Preliminary concepts are presented which permit the electrical and fluid circuits to be installed with the structural elements. A.R.H.

N81-24449# Electronics Engineering Group (1842nd), Scott AFB, Ill.
INVESTIGATION OF ALTERNATIVES TO EXOTHERMIC WELDING OF COPPER CONDUCTORS TO GROUND RODS Final Report, May - Dec. 1980
Stuart A. Wagner 15 Jan. 1981 20 p refs
(AD-A097728; Rept-1842-EEG/EEIC-TR-81-7) Avail: NTIS HC A02/MF A01 CSCL 13/8

Four types of conductor to ground rod attachments were subjected to accelerated corrosion exposure and subsequent low current, high current, and simulated lightning strike tests. All samples passed all tests. This testing indicates that presently imposed restrictions on use of other than exothermic bonds for below grade use are unnecessary. GRA

N81-24450# Technology for Energy, Knoxville, Tenn.
DEVELOPMENT AND DEMONSTRATION OF SURVEILLANCE AND DIAGNOSTICS OF ROTATING MACHINERY FOR REDUCING RADIATION EXPOSURE TO NUCLEAR POWER PLANT PERSONNEL Annual Technical Progress Report, 1 Jan. 1979 - Sep. 1980
K. R. Piety Sep. 1980 92 p Prepared for Middle South Energy, Inc., Jackson, Miss.
(Contract DE-AC02-79ET-34002)
(DOE/ET-34002/1) Avail: NTIS HC A05/MF A01

A comprehensive monitoring program for rotating machinery is described. This program is designed to reduce radiation exposure to personnel resulting from inspection, maintenance, and repair of rotating equipment in a commercial power plant. A computer based monitoring system is implemented that utilizes both process and vibration instrumentation to monitor the operational performance of fourteen major pumps, two drive turbines, twelve motors, three air compressors, the high and low pressure turbines, and the generator exciter. The monitoring system rapidly scans gross parameter values and warns the operator if alarm limits are exceeded. Once per day the system recalls hourly, gross parameter values and compares these against more sensitive alert limits and performs spectral analysis on all vibration sensors. This provides an early waring of incipient failures. The hourly gross parameters and selected spectral features are also preserved to provide a historical base for diagnostic functions. DOE

N81-24451# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
BASIC STUDY OF HEAT FLOW IN FUSION WELDING Progress Report, 1 Mar. 1980 - 28 Feb. 1981
J. Szekely and T. W. Eagar 1981 110 p
(Contract DE-AS02-78ER-04799)
(DOE/ER-04799/2) Avail: NTIS HC A02/MF A01

The process of electroslag welding (ESW) was investigated. It was concluded that the ESW process has certain inherent limitations which were not appreciated previously. The study has expanded into a more complete analysis of heat and fluid flow in arc welding. It is shown that the heat affected zone (HAZ) and fusion zone sizes are not simple functions of the net heat input as predicted by all current theories. This affects the choice of welding parameters. For example, in single pass arc welds, the smallest HAZ is usually desirable, while in multipass welding large HAZ's may be desirable to provide tempering of the previous weld beads. It may be possible to achieve both these goals at equivalent heat input by proper adjustment of the welding parameters (such as voltage, current and travel speed). Combinations of parameters are predicted which maximize or minimize the size of the heat affected zone and fusion zone at equal heat input. DOE

N81-24452# Combustion Electromagnetics, Inc., Lexington, Mass.
EFFECTS OF MICROWAVES ON THE PERFORMANCE OF INTERNAL-COMBUSTION ENGINES Final Technical Report, 30 Sep. 1979 - 31 Jan. 1981
Michael A. V. Ward 31 Jan. 1981 73 p refs
(Contract DE-AC04-78ET-13116)
(DOE/ET-13116/T13) Avail: NTIS HC A04/MF A01

The interaction of microwaves with the flame in a combustion bomb and an appropriately designed single-cylinder test engine is studied. High power microwave energy is applied to the bomb and test engine in order to stimulate the combustion processes. Work was performed on the microwave properties of conventional and modified engine combustion chambers by means of an engine simulator. Work on plasma jet ignition (as one ignition source for the microwave work), was continued. Information is presented on the microwave coupling system, high power microwave testing on a combustion bomb, and the fabrication of facilities for testing a single-cylinder test engine. The combined plasma jet/microwave system is used to advantage to burn very lean mixtures and increase their flame speed. DOE

N81-24453# McGraw-Edison Co., Franksville, Wis.
DEVELOPMENT OF A NEW TYPE OF NONLINEAR RESISTANCE VALVE BLOCK FOR SURGE ARRESTERS Final Report
T. O. Sokoly, M. A. Seitz (Marquette Univ.), J. P. Guertin, P. P. Schumacher, and M. E. Potter Dec. 1980 136 p refs
(EPRI Proj. 425-1)
(EPRI-EL-1647) Avail: NTIS HC A07/MF A01

The effect of chemical composition and processing variables on the electrical and physical characteristics of metal oxide varistors were investigated. Various chemical compositions were studied. Bismuth oxide, antimony oxide, cobalt oxide, manganese oxide, chromium oxide, nickel oxide, and aluminum oxide in a zinc-oxide based varistor were evaluated. The effect of these materials on the varistor's leakage current, discharge voltage, and energy handling capability was evaluated. Mixing procedures and sintering programs were then established for the processing of these varistors. Since the elimination of series gaps would require the metal oxide arrester to be continuously subjected to operating voltage, the work sought to determine the mechanisms and controlling variables affecting a long-term deterioration of these varistors. Based on the electrical modes of conduction, an equivalent circuit model was contructed for the devices. Methods of encapsulating a stack of varistor blocks into an epoxy housing were examined and a potential application for the gapless arrester was demonstrated. DOE

N81-24454# Westinghouse Electric Corp., Tampa, Fla. Nuclear Equipment Div.
DEVELOPMENT OF AUTOMATED WELDING PROCESS FOR FIELD FABRICATION OF THICK WALLED PRESSURE VESSELS

U. A. Schneider [1981] 14 p
(Contract DE-AC05-78ET-13511)
(DOE/ET-13511/T5) Avail: NTIS HC A02/MF A01

Research on automatic welding processes for the fabrication of thick-walled pressure vessels continued. A literature review was completed. A laboratory study of criteria for judging acceptable root parameters continued. Equipment for a demonstration facility to test the components and processes of the automated welding system was specified and is obtained. DOE

N81-24455# Energy and Minerals Research Co., Exton, Pa.
EFFICIENT ULTRASONIC GRINDING: A NEW TECHNOLOGY FOR MICRON-SIZED COAL Final Report, 15 Sep. 1979 - 14 Dec. 1980
W. B. Tarpley, Jr., P. L. Howard, and G. R. Moulder Jan. 1981 40 p refs
(Contract DE-AC02-79ER-10499)
(DOE/ER-10466/1) Avail: NTIS HC A03/MF A01

To burn coal most efficiently and cleanly, much smaller particle sizes are needed than can now be ground economically. This project was performed to demonstrate the technical feasibility of using ultrasonics to enhance grinding below the standard plant grind of 75 microns, and the extrapolate from this laboratory work the ultrasonic energy requirements for production use. Successively improved laboratory arrays demonstrated a repeatable production of particulates from 200 micron coal to the desired size ranges (approximately 35% below 7 microns, 95% below 44 microns) with selective liberation of ash and pyrite inclusions to facilitate removal, with equipment translatable to production use, and the possibility of only 37 kwh/ton energy input requirement. DOE

N81-24456# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.
IN-SERVICE MEASUREMENTS OF TURBOGENERATOR BEARING VERTICAL MISALIGNMENTS
G. L. Lapini, T. Rossini, E. Gadda (Ente Nazional per l'Energia Electrica, Milan), and A. Benanti (Ente Nazional per l'Energia Electrica, Milan) 1980 13 p refs Presented at EPRI Workshop on Rotor Forging for Turbines and Generators, Asilomar Conf. Site, Calif., 15-17 Sep. 1980
(CISE-1631) Avail: NTIS HC A02/MF A01

Two instruments were developed which measure long-term trends in alignment variations. The catenary measuring instrument which works on the communicating vessel principle, is used in spot measurements and has a maximum measuring error of 0.02 mm. The electronic differential altimeter also works on the communicating vessel principle, but liquid levels are converted into continuous voltage variations by proximity transducers fixed to the cup tops. A voltage proportional to the relative displacement of the n measuring cup, and for the reference cup, is obtained. Temperature and pressure equalization are described. Examples of applications are presented. Author (ESA)

N81-24457# Bureau of Mines, Rolla, Mo.
EXPERIMENTS IN HOT-ROLLING AND FORGING OF DUCTILE CAST IRON
L. A. Neumeier, B. A. Betts, and R. L. Crosby 1980 43 p refs
(PB81-148256; BM-RI-8448) Avail: NTIS HC A03/MF A01 CSCL 13H

Hot-rolling and forging characteristics of experimental ductile iron castings, both sand and permanent-mold, made with charges containing up to 70 pct foundry pig iron and 95 pct steelmaking pig iron were investigated. Between 1,550 and 1,950 F, most castings could be rolled to 90 pct reduction or forged to 70 pct reduction without serious cracking. Charge and composition have less bearing on workability than on subsequent properties. Permanent mold casting could be worked as readily as sand castings at 1,750 and 1,950 F. Plasticity improved with temperature. Small billets were also forged cold to 50 pct reduction without cracking. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N81-24458 Arizona Univ., Tucson.
THE ESTIMATION OF LARGE SCALE COMPLEX SYSTEM RELIABILITY Ph.D. Thesis
William Arledge Metler 1980 217 p
Avail: Univ. Microfilms Order No. 8109050

A methodology is developed with a Bayesian approach for the confidence interval estimation of the reliability of large scale complex systems. Applicable configurations include combinations of series, parallel, k out of n(k/n), and partial k/n (e.g., bridge). The individual components are assumed to fail independently of one another and the lifetimes of the components are distributed according to an exponential distribution. The theory of hierarchical composition of moments is developed from the theory of linear composition of structures. A moment compiler implements the theory by computing any moment of system reliability given the moments of component reliability. A Bayesian approach is used at the component level to model the distribution of component reliability. At the system level, three methods are used to estimate the system distribution and thus confidence intervals of system reliability. The three methods adopted (in order of increasing computer time) are the log-gamma, the Fourier, and the Monte Carlo. Dissert. Abstr.

N81-24459# Memphis Light, Gas and Water Div., Tenn.
QUALITY ASSURANCE/QUALITY CONTROL PROGRAM MANUAL
13 Oct. 1980 242 p Prepared in cooperation with Foster Wheeler Energy Corp., Livingston, N.J.
(Contract DE-AC02-77ET-13046)
(DOE/ET-13046/T73) Avail: NTIS HC A11/MF A01

The organization and functional activities responsible for a quality assurance/quality control program are identified. The authority and responsibilities in planning, managing and controlling the program under codes, specifications, and standards are described. The interrelation of quality assurance/quality control responsibilities are also illustrated. R.C.T.

N81-24460# Centre Technique des Industries Mecaniques, Senlis (France).
ANALYSIS AND CHARACTERIZATION OF DEFECTS BY ULTRASONIC REFLECTOMETRY AND DIFFRACTOMETRY [ANALYSE ET CARACTERISATION DES DEFAUTS PAR REFLECTOMETRIE ET DIFFRACTOMETRIE ULTRASONORE]
Y. Pralus 23 Sep. 1980 7 p In FRENCH 2 Vol.
(CETIM-15-H-237-Pt-1) Avail: NTIS HC A02/MF A01

Multidirectional ultrasonic flaw analysis is presented. A motorized positioning device orients the pickups around a mechanically independent immersion tank. The electronic command system for the positioning equipment can be operated in a manual, automatic, or programmed mode. A minicomputer (PDP 11/10) using BASIC, is incorporated into the system. It linearizes the motion of the pickup arms, provides the interface for a Tektronix 611 visualization system, commands a numerical plotter, and performs fast Fourier transforms for flaw characterization. Author (ESA)

N81-24461# Centre Technique des Industries Mecaniques, Senlis (France).
ANALYSIS AND CHARACTERIZATION OF DEFECTS BY ULTRASONIC REFLECTOMETRY AND DIFFRACTOMETRY [ANALYSE ET CARACTERISATION DES DEFAUTS PAR REFLECTOMETRIE ET DIFFRACTOMETRIE ULTRASONORE, ANNEXE 1]
Y. Perrin and Y. Pralus 23 Sep. 1980 45 p In FRENCH 2 Vol.
(CETIM-15-H-237-Pt-1-Annex) Avail: NTIS HC A03/MF A01

A user manual for the compilation of BASIC programs to be implemented on a PDP 11 computer is presented. The computer system commands an ultrasonic flaw detection test setup and provides data handling facilities. The main functions of the system

are: automatic operation of positioning devices operation of a plotter; and fast Fourier transformation of reflectometric and diffractometric data. Author (ESA)

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N81-24462 Washington Univ., Seattle.
PROBABLE RESPONSE OF EARTHQUAKE EXCITED LINEAR SYSTEMS Ph.D. Thesis
Terry Clifford Golden 1980 175 p
Avail: Univ. Microfilms Order No. 8109730

A model to predict the probability of exceeding any response threshold for a particular linear structure was developed. The model is applicable to all linear structures with low damping and with wideband design environments. Earthquake excitation was examined. The probability model allows the response to be nonstationary, and makes no assumptions for the input or response probability distribution. The probability of the exceedance model is eact for 1 deg of freedom systems, and a good estimate for 2 and 3 deg of freedom systems. The approximation model employs the structural characteristics and response spectra to estimate the probability of exceedance. The developed probability equations are useful for structural design or evaluation of the response of systems with 3 or less deg of freedom. The probability equations for more than 3 deg of freedom require numerical integration over two or more random variables. Dissert. Abstr.

N81-24463 Case Western Reserve Univ., Cleveland, Ohio.
ON THE STATE SPACE RANDOM VIBRATION APPROACH Ph.D. Thesis
Amitabha DebChaudhury 1981 252 p
Avail: Univ. Microfilms Order No. 8109580

Closed form analytical solutions for the evolutionary mean and covariance matrices of the responses of linear multiple degree of freedom system subjected to nonstationary, nonwhite, correlated, vector valued excitation, obtained by utilizing a modal state space approach are examined. The simplicity of the state space approach is attributed to the augmentation of the system equations with those of the filters. The formulation is applicable to both earthquake and wind type loading and to any linear system, discrete or continuous, as long as frequencies and mode shapes are available and modal analysis is appropriate. Three example problems are presented to demonstrate the capability and potential of the formulation. Evolutionary first passage probabilities are computed utilizing the time dependent variances of the responses to nonstationary excitation. Time domain results of the evolutionary first passage probabilities of envelope crossing are also presented. E.A.K.

N81-24464 Case Western Reserve Univ., Cleveland, Ohio.
INSTABILITY ANALYSIS OF TAPERED MEMBERS USING FINITE-ELEMENT METHOD Ph.D. Thesis
Mohammed Naim Kayum 1981 156 p
Avail: Univ. Microfilms Order No. 8109594

A finite element formulation for the linear instability problem of tapered members is presented. The total potential energy expression for the lateral-torsional instability of an I-section element, that is parabolically tapered in web and flanges and is acted upon by a general system of transverse and longitudinal loading, is obtained. New section properties which affect buckling behavior of tapered members are defined. Fourth-order polynomial shape functions are introduced whose coefficients depend upon element geometry and, therefore, is a closer approximation to the displacement configuration of the element. The more generalized formulation is then reduced for the special case of linearly tapered members and, by using third-order polynomial shape functions, closed-form expressions are obtained for elements of the stiffness and geometric matrices. Some problems of the linearly tapered members are solved and their convergence behavior studied. Dissert. Abstr.

N81-24465 Illinois Univ. at Urbana-Champaign.
VIBRATION OF BUILDINGS UNDER RANDOM WIND LOADS Ph.D. Thesis
Erdal Safak 1980 141 p
Avail: Univ. Microfilms Order No. 8108648

Wind and earthquakes are two of the major environmental forces acting on multistory buildings. Since current design practice often leads to slender and flexible buildings, the dynamic effects of the wind are of increasing importance. A method is developed for analyzing the three dimensional dynamic response of buildings subjected to random wind loads. The analysis procedure utilizes random vibration techniques and parallels the gust factor methods currently used in engineering practice. Expressions for the spectra of the along wind forces, of the across-wind forces induced by vortex shedding and of the total dynamic torque were developed for normally incident wind. Rectangular buildings were modeled as either three dimensional continuous shear beams or flexural beams. The results of the analysis are the expected maximum translation and acceleration of any point on the structure. The method is general and may be extended to include the analysis of buildings subjected to earthquake-type loadings. Dissert. Abstr.

N81-24466 Illinois Univ. at Urbana-Champaign.
RANDOM VIBRATIONS OF STRUCTURES UNDER PARAMETRIC AND NON-PARAMETRIC EARTHQUAKE LOADS Ph.D. Thesis
Teng-Yuan Shih 1980 270 p
Avail: Univ. Microfilms Order No. 8108658

The effects of gravity force and vertical component of earthquake acceleration on the seismic response of structures were assessed and the versatility of the mathematical theory of the Markov random process in structural dynamics applications was demonstrated. It was found that (1) the deterministic gravity force reduces the lateral stiffness against the floor motion; (2) the vertical earthquake acceleration plays the role of a random parametric excitation in the equation of motion for the floor mass; (3) in some hysteretic systems, the gravity force and the vertical earthquake excitation increases the amplitude of the structural motion, and the permanent deformation of a structure after the structural motion stops; (4) for the soil-structure system the gravity force and vertical earthquake acceleration play even more important roles than if the base of the structure were fixed; (5) the correlation between the horizontal and vertical earthquake accelerations contributes to the mean-square structural response if the mean response of the system is not zero; (6) any practical spectra density of an excitation can be approximated by a rational function of frequency. Dissert. Abstr.

N81-24467 Texas Univ. at Arlington.
REDUCED INTEGRATION AND EXTERIOR PENALTY METHODS FOR FINITE ELEMENT APPROXIMATIONS OF CONTACT PROBLEMS IN INCOMPRESSIBLE LINEAR ELASTICITY Ph.D. Thesis
Young Joon Song 1980 140 p
Avail: Univ. Microfilms Order No. 8109243

Finite element approximations of penalty formulations to the problem of unilateral contact for an incompressible linearly elastic body are considered. The convergence of the penalty formulation to the original constrained problem is established. The existence and error estimates of the solutions of finite element approximations are given. The use of reduced integration is investigated, which makes it possible to satisfy a crucial stability condition to the penalty-finite element methods for certain finite elements. A projection scheme is developed to provide a stable condition for incompressibility constraint for a certain element. Dissert. Abstr.

N81-24468 Stanford Univ., Calif.
SHEAR AND MOMENT TRANSFER IN THICK-WALLED REINFORCED CONCRETE CYLINDERS Ph.D. Thesis
Maher Abdulmajid Bader 1981 263 p
Avail: Univ. Microfilms Order No. 8108891

A summary of the flexural and shear behavior of reinforced concrete elements is presented with emphasis on elements with small shear span to depth ratios. The established theory is extended to include the particular case of thick-walled reinforced concrete cylinders. A review of specific model studies on reinforced concrete shear walls and thick-walled cylinders follows. An experimental

simulation of the response of representative prototype elements, such as support structures for pressure vessels, necessitated the use of small-scale models. A summary of microconcrete mix design practices, supported by material test results is presented. The techniques used for the fabrication of the model reinforcement and the model structures are discussed. Three 1/35 scale models with different height to diameter ratios were fabricated and tested. Dissert. Abstr.

N81-24469 Washington Univ., Seattle.
ELASTODYNAMIC ANALYSIS OF CRACKED FINITE BODIES BY THE FINITE ELEMENT METHOD INCLUDING SINGULAR ELEMENTS Ph.D. Thesis
Christian K. Gunther 1980 204 p
Avail: Univ. Microfilms Order No. 8109731

A finite element procedure was developed for the solution of elastodynamic problems involving cracked finite bodies. The procedure utilizes a singular element which provides for the direct solution of time-dependent stress intensity factors for stationary and moving cracks. The finite element formulation including a detailed description of the development of the sinular element is presented. The element matrices are derived from a variational principle involving functional which in each element depends on independent interior and boundary displacement and boundary tractions. The interior displacement functions consist of terms of the constant velocity dynamic crack solution. The coefficient of the lowest order term is proportional to the stress intensity factor. Boundary displacement and tractions are selected to provide continuity in the limit between singular and regular elements. The resulting discretized governing equations are solved by an implicit method of temporal integration. Dissert. Abstr.

N81-24470*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
COMPRESSION TEST FIXTURE Patent Application
George C. Shanks, inventor (to NASA) (McDonnell Douglas Corp., Long Beach, Calif.) Filed 13 Feb. 1981 11 p Sponsored by NASA
(NASA-Case-MSC-18723-1; US-Patent-Appl-SN-234223) Avail: NTIS HC A02/MF A01 CSCL 20K

An apparatus for compressive testing of a test specimen may comprise vertically spaced upper and lower platen members between which a test specimen may be placed. The platen members are supported by a fixed support assembly. A load indicator is interposed between the upper platen member and the support assembly for supporting the total weight of the upper platen member and any additional weight which may be placed on it. Operating means are provided for moving the lower platen member upwardly toward the upper platen member whereby an increasing portion of the total weight is transferred from the load indicator to the test specimen. The testing apparatus may include devices for limiting the movement of the lower platen member toward the upper platen member to prevent permanent deformation in the test specimen. In one embodiment, the limit devices include a number of rods attached to one of the platen members and a vertically-adjustable extension member engageable with the other platen member. NASA

N81-24471*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STATIC AND YAWED-ROLLING MECHANICAL PROPERTIES OF TWO TYPE 7 AIRCRAFT TIRES
John A. Tanner, Sandy M. Stubbs, and John L. McCarty May 1981 80 p refs
(NASA-TP-1863; L-14125) Avail: NTIS HC A05/MF A01 CSCL 20K

Selected mechanical properties of 18 x 5.5 and 49 x 17 size, type 7 aircraft tires were evaluated. The tires were subjected to pure vertical loads and to combined vertical and lateral loads under both static and rolling conditions. Parameters for the static tests consisted of tire load in the vertical and lateral directions, and parameters for the rolling tests included tire vertical load, yaw angle, and ground speed. Effects of each of these parameters on the measured tire characteristics are discussed and, where possible, compared with previous work. Results indicate that dynamic tire properties under investigation were generally insensitive to speed variations and therefore tend to support the conclusion that many tire dynamic characteristics can be obtained from static and low speed rolling tests. Furthermore, many of the tire mechanical properties are in good agreement with empirical predictions based on earlier research. R.C.T.

N81-24472# General Electric Co., St. Petersburg, Fla. Corporate Research and Development Dept.
METHODOLOGY FOR PLASTIC FRACTURE Final Report
C. F. Shih, W. R. Andrews, H. G. deLorenzi, M. D. German, R. H. VanStone, and D. F. Mowbray Mar. 1981 285 p refs Sponsored by Electric Power Research Inst.
(EPRI Proj. 601-2)
(EPRI-NP-1735) Avail: NTIS HC A13/MF A01

A capability was developed for analyzing and predicting the fracture response of nuclear pressure containing components in the ductile regime of material response. The results of the analytical and experimental investigations were used as the basis for formulating an engineering (design) approach to elastic-plastic fracture problems. This approach was applied in a fracture analysis of stainless steel piping. The analysis predicts the fracture and crack mouth opening responses and demonstrates the effect of system compliance. DOE

N81-24473# Atomic Weapons Research Establishment, Aldermaston (England). Nuclear Power Development Labs.
CREEP-FATIGUE BEHAVIOR OF FOUR CASTS OF TYPE 316 STAINLESS STEEL
J. Wareing Jan. 1981 30 p refs
(ND-R-512(S)) Avail: NTIS HC A03/MF A01

Low-cycle fatigue tests including hold periods up to 24 h at maximum tensile strain were conducted on four casts of Type 316 stainless steel in the temperature range 570 to 625 C. These resulted in failure times up to 4000 h. Fatigue life is reduced as the hold period increases, but the extent of life reduction varies from material to material and with test temperature. For two casts of material this initial life reduction is followed by an increase in life as hold periods are extended. The results are rationalized in terms of prevailing fracture processes, and the implication for the extrapolation of short-term data is discussed. DOE

N81-24474# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
STRAIN CONCENTRATION FACTOR AS A FUNCTION OF STRAIN IN A DESIGN APPLICATION
R. E. Smith 1981 16 p refs Presented at the Struct., Structural Dyn. and Mater. Conf., Atlanta, Apr. 1981
(Contract DE-AC15-76CL-02395)
(CONF-810401-1) Avail: NTIS HC A02/MF A01

Results are presented of a detailed inelastic finite element analysis for a part of the Clinch River Breeder Reactor Control Rod Drive Mechanism. Plastic strain concentration factors may in fact be less than corresponding elastic strain concentration factors for nominal strain as low as .2 percent. It is presently common practice to approximate inelastic strain concentration factors as the square of the elastic concentration factors. Neuber's relation for predicting strain concentration factor is explored through the cross section of the component analyzed. DOE

N81-24475# Bristol Univ. (England). Dept. of Aeronautical Engineering.
AN EXPERIMENTAL INVESTIGATION OF NORMALLY APPLIED STATIC LOADING OF A HARDPOINT IN A HONEYCOMB SANDWICH STRUCTURE B.S. Thesis
M. J. D. Castle and I. A. C. Horsfall Jun. 1980 42 p refs
(BU-252) Avail: NTIS HC A03/MF A01

Normally applied static loading of resin/microballoon hardpoints in Nomex paper honeycomb and glass fiber reinforced plastic skin sandwich panels was studied to determine design criteria for load bearing points in a remotely piloted vehicle. Panels of two thicknesses and varying areas were tested and the hardpoint sizes were also varied. A panel elastic limit load was defined to be that load above which permanent damage occured in the honeycomb core. Increasing the depth of the honeycomb core and, to a lesser extent, the area of the panel produces an increase in the elastic limit load, as does increasing the hardpoint size. No best hardpoint size or panel thickness is specified, although recommendations are given. Author (ESA)

N81-24476# Bristol Univ. (England). Dept. of Aeronautical Engineering.
MEASUREMENT OF THE FREQUENCY RESPONSE FOR A PRESSURE TUBE/TRANSDUCER ASSEMBLY B.S. Thesis
H. Lyttle and C. Woodward Jun. 1980 55 p refs
(BU-255) Avail: NTIS HC A04/MF A01

The effects of variations in tubing length and diameter were studied. A pure tone sound generator was the source of original pressure fluctuation. These tones were provided by the resonance of an organ pipe arrangement, driven at one end by a loudspeaker with the other end blocked by a solid plug into which the pressure measuring devices were fitted. At frequencies other than resonance frequencies the sounds were distorted, being superpositions of several frequencies. A set of readings was obtained for four different lengths of small plastic tubing ranging from 6.8 cm to 10.5 cm, all with a 4.6 cm length of brass tubing set into the face of the plug. Experimental data are compared with results from a computer model of the tube-transducer system. Such systems display many degrees of freedom, but it is found that the frequency response in the region of the lowest natural frequency can be approximated by a simple second-order system and an attempt is made to fit the measured data to such a model. Author (ESA)

N81-24477# Centre Technique des Industries Mecaniques, St. Etienne (France).
UPDATE FOR THE GUIDE TO KT Final Report [MISE A JOUR DU GUIDE DU KT]
J. P. Faurie 20 Oct. 1980 35 p refs In FRENCH
(CETIM-1-1C-12-1) Avail: NTIS HC A03/MF A01

Studies of stress concentration problems for certain specimen geometries were undertaken. Results are used to assess potential revisions to the guide to KT. The guide is introduced as a documentation scheme, characterized by simplicity in search strategies while particularly well adapted to stress calculation design problems. Recommended data revisions concern plates with two symmetrical millings, notched plates, plates with a single hole, and plates having several holes. Special consideration is suggested for round bars with lathed segments. Author (ESA)

N81-24478# Centre Technique des Industries Mecaniques, Senlis (France).
CYCLIC ENERGY EFFICIENCY OF A STAMPING TECHNIQUE Final Report [RENDEMENT ENERGETIQUE D'UNE FRAPPE D'ESTAMPAGE]
Montagut and Batit Sep. 1980 39 p In FRENCH
(CETIM-1-3K-20-9) Avail: NTIS HC A03/MF A01

The energy efficiency of a stamping procedure was determined for a sequence of shocks. Theoretical values from the literature are found to be widely diverse, inhibiting proper calculation of the number of cycles needed to form a part. A high speed camera was used to assess the stamping tool behavior. Measurements of impact velocity and rebound height, during stamping of four test shapes with a 630 kg forge, are used to calculate the shock transfer coefficient, and thus the work efficiency. Results confirm that theoretical values of efficiency and of energy dissipated in plastic deformation are generally underestimated in comparison with experimental values.
Author (ESA)

N81-24479# Centre Technique des Industries Mecaniques, Senlis (France).
CALCULATION METHOD FOR THE EXPERIMENTAL SIMULATION OF STRUCTURES Final Report [METHODE DE CALCUL POUR LA SYNTHESE EXPERIMENTALE DE STRUCTURES]
Y. Ousset 20 Nov. 1980 7 p In FRENCH
(CETIM-11-E-261) Avail: NTIS HC A02/MF A01

Software which predicts the influence of local modifications on the dynamic behavior of a structure is presented and criticized. A Galerkin method is studied both for undamped structures and damped structures. A matrix approach combining a stiffness matrix with a matrix of mass is used. The method correctly describes proportional damping given experimentally measured input data. However, for the other problems treated, the program is incapable of performing its function. Author (ESA)

N81-24480# Centre Technique des Industries Mecaniques, Senlis (France).
THE MONITORING OF MACHINES [SURVEILLANCE DES MACHINES]
M. Gaillochet Aug. 1980 44 p refs In FRENCH 2 Vol.
(CETIM-15-J-041-PT-2) Avail: NTIS HC A03/MF A01

The application of classical vibration analysis to the surveillance of the mechanical condition of machines is described. Automated procedures handled by specialized computers, using advanced signal processing techniques, are sought. Vibration measurement and analysis are reviewed, covering sensors and recorders, frequency analyzers, and methods for visualizing results. Existing procedures for monitoring machine wear are touched on. A method for determining vibration signatures is proposed. As an example, the vibrations generated by reduction box elements are characterized. A low frequency Fourier analysis is performed. The individual signatures of the gear wheels are identified. A statistical analysis of the global signal is then given. The implications of vibration analysis as a maintenance tool are brought out, emphasizing the advantages to be accrued through automation of wear diagnostics. Author (ESA)

N81-24481# Centre Technique des Industries Mecaniques, Senlis (France).
THE MONITORING OF MACHINES. PRELIMINARY STUDY OF A TRANSMISSION [SURVEILLANCE DES MACHINES. ETUDE PRELIMINAIRE SUR UNE BOITE DE VITESSE]
G. Garcin Sep. 1980 15 p In FRENCH 2 Vol.
(CETIM-15-J-041-PT-3) Avail: NTIS HC A02/MF A01

The application of vibration analysis to the surveillance of the mechanical condition of machines is proposed. A signal processing method, given vibration measurement data, is suggested. This method was validated, using a wear test setup for studying the behavior of an automobile transmission to failure. The test bench is described, including type and frequency of measurements as well as measurement methodology. Results demonstrate the feasibility of diagnosing wear on machine parts through the statistical analysis of associated vibration signatures. Author (ESA)

N81-24482# Societe Nationale Industrielle Aerospatiale, Toulouse (France).
THEORETICAL AND EXPERIMENTAL STUDIES OF CRACK PROPAGATION
J. M. Thomas Paris 1980 16 p refs In FRENCH Presented at ICAS Conf., Munich, 13-17 Oct. 1980
(SNIAS-802-111-107; ICAS-80-19.1) Avail: NTIS HC A02/MF A01

The correlation between theoretical and experimental results from the study of crack propagation in aircraft structures is discussed. The experimental identification of stress intensity factors and the measurement of crack propagation rate are described. The mathematical implications of the influence of stress ratio, the effects of overloading, and of complex spectra are brought out. The utility of these data in aeronautical engineering as well as design application aspects are shown. Statistical and probabilistic treatment are also mentioned. Author (ESA)

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N81-24483 Oregon State Univ., Corvallis.
BED MATERIAL ROUTING AND STREAMBED COMPOSI-

TION IN ALLUVIAL CHANNELS Ph.D. Thesis
William Longstreth Jackson 1981 174 p
Avail: Univ. Microfilms Order No. 8100010

A descriptive model of bed material routing was developed for alluvial streams exhibiting sequences of pools and armored riffles. The model assumes that channel geometry, sediment transport competence and the availability of sediments for transport are all nonuniform in the downstream direction. Bedload transport is described as occurring in two relatively distinct phases. Phase 1 involves the transport of predominantly sand-size bed materials over stable riffles. Phase 2 occurs at flows which are greater than those required to entrain riffle armor and involves the transport of riffle sediments in addition to phase 1 sediments. The intrusion of fine sediments into the pore spaces of stable riffles dominates during phase 1 transport. The deposition of entirely new riffle features occurs during phase 2 transport. The particle size gradation of riffles is determined primarily by bed material deposition. Flume studies showed the intrusion process to be selective towards finer sediments which cannot be filtered by the riffle sediment matrix. Dissert. Abstr.

N81-24484* National Aeronautics and Space Administration, Washington, D. C.
EARTH RESOURCES: A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 29, APRIL 1981
Apr. 1981 95 p
(NASA-SP-7041(29)) Avail: NTIS HC $10.00 CSCL 05B

This bibliography lists 308 reports, articles, and other documents introduced into the NASA scientific and technical information system between January 1, 1981 and March 31, 1981. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis. Author

N81-24485 Stanford Univ., Calif.
TRANSPORT OF ION-EXCHANGING SOLUTES DURING GROUNDWATER RECHARGE Ph.D. Thesis
Albert Joseph Valocchi 1981 263 p
Avail: Univ. Microfilms Order No. 8109009

Due to increased interest in wastewater reuse, groundwater recharge of municipal effluents is becoming a common feature of many regional water resources plans. In order to determine the optimal combination of treatment processes and recharge operations so as to prevent pollution of the groundwater basin, generalized mathematical models to predict the movement of chemically reacting contaminants must be developed. A mathematical model of the transport of ion-exchanging species governed by local chemical equilibrium was developed, based upon steady flow in a two dimensional areal, confined, leaky aquifer system. The resulting model equations were solved numerically using the Galerkin-Finite Element Method. The numerical code was tested and verified using known analytical solutions to certain simplified ion-exchange problems. Dissert. Abstr.

N81-24486 Texas Univ. at Arlington.
INTERPRETATION OF FLOOD PALEOHYDROLOGY USING SLACKWATER DEPOSITS, LOWER PECOS AND DEVILS RIVERS, SOUTHWESTERN TEXAS Ph.D. Thesis
Robert Craig Kochel 1980 387 p
Avail. Univ. Microfilms Order No. 8109196

In the lower Pecos and Devils River basins in southwestern Texas, estimates of the frequency and discharge of large floods can be refined and extended over the past 10,000 years through the study of slackwater sediments. The accumulation and preservation of slack-wear sediments appears to be controlled by tributary-mainstream junction morphology and tributary basin drainage efficiency. Radiocarbon dating of wood, charcoal, buried soils, and fine grained detritus in slackwater deposits provides a pale flood record for these rivers. Significant morphological changes occur during large floods, but only if there has been adequate recovery time between floods for the channels to readjust to more frequent low magnitude flow conditions. This morpho-stratigraphic approach may be combined with other geomorphic and botanic methods of extending flood frequency information and offers a relatively rapid and inexpensive method of assessing the risk of catastrophic floods. Dissert. Abstr.

N81-24487 Missouri Univ. -Columbia.
DEVELOPMENT OF AUTOMATED TECHNIQUES FOR CREATING A NATURAL RESOURCES INFORMATION SYSTEM Ph.D. Thesis
Tachpong Hotrabhavananda 1980 252 p
Avail: Univ. Microfilms Order No. 8108804

A system which analyzes LANDSAT multispectral data and digitizes various types of transparency maps which can then be integrated with the LANDSAT multispectral data was developed. The analysis of LANDSAT images consists of geometric correction and land cover classification. In the geometric correction procedure, the LANDSAT image is rescaled and registered to UTM coordinates by linear approximation method. The system features techniques for automatically digitizing the information contained in any map format such as soil, or slope maps. A special dynamic thresholding technique was developed for separating the distinctive areas from the background. An automatic line following routine for the purpose of digitizing line drawing maps technique to eliminate flaws in the contour line and a line thinning algorithm are included in the line drawing map digitizing process. A method which integrates the LANDSAT classification and digitized data and demonstrates an example of a natural resources information data base system is also presented. Dissert. Abstr.

N81-24488*# Florida Univ., Gainesville. Remote Sensing Applications Lab.
A REMOTE SENSING EVALUATION OF POTENTIAL FOR SINKHOLE OCCURRENCE
Jay Casper, Byron Ruth, and Janet Degner, Principal Investigators Jan. 1981 103 p Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E81-10143; NASA-CR-164245) Avail: NTIS HC A06/MF A01 CSCL 08G

The relationship between lowering of the water table and sinkhole development in Pierson and in Hillsborough County, Florida was investigated. The locations of recently developed (1973) collapses were examined with respect to lineaments or fracture traces that are expressed in the terrain and visible in aerial photography and satellite imagery. It was anticipated that these relationships would provide the basis for establishment of criteria for mapping those land areas that have the greatest potential for sinkhole development. A very good correlation was found between mapped lineament intersections and known location of sinkhole occurrences for both study areas. This indicates that lineament and fracture trace mapping may be very useful in locating zones with the greatest potential for sinkhole development. It is further shown that this information is quite beneficial in land use planning applications. R.C.T.

N81-24489*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXPERIMENTAL APPLICATION OF LANDSAT TO GEOBOTANICAL PROSPECTING OF SERPENTINE OUTCROPS IN THE CENTRAL APPALACHIAN PIEDMONT OF NORTH AMERICA
Howard W. Mielke, Principal Investigator (Macalester Coll.) Jul. 1980 25 p refs ERTS
(E81-10144; NASA-TM-80741) Avail: NTIS HC A02/MF A01 CSCL 08B

The use of LANDSAT as a tool for geobotanical prospecting was studied in a 13,137 sq km area from southeastern Pennsylvania to northern Virginia. Vegetation differences between known serpentine and non-sepentine sites were most easily distinguished on early summer images. A multispectral signature was derived from vegetation of two known serpentine sites and a map was produced of 159 similar signatures of vegetation in the study area. Authenticity of the serpentine nature of the mapped sites was checked via geochemical analysis of collected soils from 14% of the sites. Overall success of geobotanical prospecting

was about 35% for the total study area. When vegetation distribution was taken into account, the success rate was 67% for the region north of the Potomac, demonstrates the effectiveness of the multispectral satellite for quickly and accurately locating mineral sensitive vegetation communities over vast tracts of land. A.R.H.

N81-24490*# Washington Univ., Seattle. Dept. of Geological Sciences.

GEOLOGICAL REMOTE SENSING: IDENTIFICATION AND MAPPING OF ROCK TYPES FOR NON-RENEWABLE RESOURCES Semiannual Report, 1 Oct. 1980 - 31 Mar. 1981

John B. Adams, Principal Investigator 22 Apr. 1981 2 p ERTS

(Grant NAGw-85)

(E81-10145; NASA-CR-164259) Avail: NTIS HC A02/MF A01 CSCL 08B

Efforts concentrated on developing a technique for relating laboratory spectral reflectance curves of known rocks and vegetation on LANDSAT multispectral images. The techniques involves determination of the laboratory spectral signature of a material of interest and searching a stack of spatially registered multispectral images for materials with the desired spectral signature. Changes in spectral reflectance caused by vegetation cover were also investigated in surface samples from Hawaii. T.M.

N81-24491*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

DESIGN AND EVALUATION OF PICK-UP TRUCK MOUNTED BOOM FOR ELEVATION OF A MULTIBAND RADIOMETER SYSTEM

M. E. Bauer, Principal Investigator and Roy Tsuchida Apr. 1981 36 p ref Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS

(Contract NAS9-15466; Proj. AgRISTARS)

(E81-10150; NASA-CR-164264; SR-P1-04079; LARS-TR-040981) Avail: NTIS HC A03/MF A01 CSCL 14B

Three concepts were considered for the boom design: a one-piece boom with a trolley, a folding boom, and a telescoping boom. The telescoping boom was selected over the other two concepts because of its easy manual operation. The boom is designed to mount on the bed of a pick-up truck and elevate the radiometer system 8 meters above the ground and 4 meters away from the truck. The selection of the boom components is discussed with justification of the final choice. Results of performance tests and one season's operation of the completed boom are reported. T.M.

N81-24492*# Texas A&M Univ., College Station. Remote Sensing Center.

DRYLAND PASTURE AND CROP CONDITIONS AS SEEN BY HCMM Final Report

J. C. Harlan, Principal Investigator, W. D. Rosenthal, and B. J. Blanchard [1981] 63 p refs Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM

(Contract NAS5-24383)

(E81-10154; NASA-CR-164268; RSC-3712-12) Avail: NTIS HC A04/MF A01 CSCL 08E

Techniques developed from aircraft flights over the Washita watershed in central Oklahoma were applied to HCMM data analysis. Results show that (1) canopy temperatures were accurately measured remotely; (2) pasture surface temperature differences detected relative soil moisture differences; (3) pasture surface temperature differences were related to stress in nearby wheat fields; and (4) no relationship was developed between final yield differences, thermal infrared data, and soil moisture stress at critical growth stages due to a lack of satellite thermal data at critical growth stages. The HCMM thermal data proved to be quite adequate in detecting relative moisture differences; however, with a 16 day day/night overpass frequency, more frequent overpasses are required to analyze more cases within a 7 day period after the storm. Better normalization techniques are also required. A.R.H.

N81-24493*# Alaska Univ., Fairbanks. Geophysical Inst.

APPLICATIONS OF REMOTE-SENSING DATA IN ALASKA Annual Report, 1 Jul. 1976 - 30 Sep. 1977

J. M. Miller, Principal Investigator 30 Sep. 1977 132 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS

(Grant NGL-02-001-092)

(E81-10156; NASA-CR-164270) Avail: NTIS HC A07/MF A01 CSCL 08B

Public and private agencies were introduced to the use of remotely sensed data obtained by both satellite and aircraft, and benefitted from facilities for data processing enhancement and interpretation as well as from the institute's data library. Cooperative ventures involving the performance of operational activities included assistance to the Bureau of Land Management in the suppression of wildfires; the selection of sites for power line right-of-way; the mapping of leads in sea ice; determination of portions of public lands to be allocated for small scale farming; the identification of areas for large scale farming of barley; the observation of coastal processes and sediment transport near Prudhoe Bay; the establishment of a colar infrared file of the entire state; and photomapping for geological surveys. Monitoring of the outer continental shelf environment and reindeer herds was also conducted. Institutional constraints to full utilization of satellite remote sensing in the state are explored and plans for future activites include the generation of awareness by government agencies, the training of state personnel, and improving coordination and communication with users. A.R.H.

N81-24494*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A PARAMETERIZATION OF EFFECTIVE SOIL TEMPERATURE FOR MICROWAVE EMISSION

B. J. Choudhury, T. J. Schmugge, and T. Mo, Principal Investigators (Computer Sciences Corp., Silver Spring, Md.) Mar. 1981 14 p refs Submitted for publication Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS

(Proj. AgRISTARS)

(E81-10157; NASA-TM-82100; SM-G1-04050) Avail: NTIS HC A02/MF A01 CSCL 08M

A parameterization of effective soil temperature is discussed, which when multiplied by the emissivity gives the brightness temperature in terms of surface (T sub o) and deep (T sub infinity) soil temperatures as T = T sub infinity + C (T sub o - T sub infinity). A coherent radiative transfer model and a large data base of observed soil moisture and temperature profiles are used to calculate the best-fit value of the parameter C. For 2.8, 6.0, 11.0, 21.0 and 49.0 cm wavelengths, The C values are respectively 0.802 + or - 0.006, 0.667 + or - 0.008, 0.480 + or - 0.010, 0.246 + or - 0.009, and 0.084 + or - 0.005. The parameterized equation gives results which are generally within one or two percent of the exact values. M.G.

N81-24495*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

CALCULATIONS OF THE SPECTRAL NATURE OF THE MICROWAVE EMISSION FROM SOILS

T. Mo (Computer Sciences Corp., Silver Spring, Md.), T. J. Schmugge, and B. J. Choudhury, Principal Investigators Aug. 1980 66 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS

(Proj. AgRISTARS)

(E81-10158; NASA-TM-82002; SM-GO-04018) Avail: NTIS HC A04/MF A01 CSCL 08M

The brightness temperatures for a set of soil profiles observed at USDA facilities in Arizona and Georgia were calculated at the wavelengths of 2.8, 6, 11, 21, and 49 cm using a coherent radiative transfer model. The soil moisture sampling depth is found to be a function of wavelength and is in the range 0.06 to 0.1 of a wavelength. The thermal sampling depth also depends on wavelength and is approximately equal to one wavelength at dry soil condition and 0.1 - 0.5 wavelengths at wet soil conditions. Calculated values of emissivity show strong diurnal variations

when the soils are wet, while there is little diurnal change when the soil is dry. The soil moistures within the four depth intervals of 0-2, 0-5, 0-9, and 0-15 cm were parameterized as function of the calculated emissivity and brightness temperature. Best-fit parameters and correlation coefficients are presented for five wavelengths. Interrelationships among the effective temperature, surface temperature, and emissivity are displayed. A.R.H.

N81-24496*# Calspan Advanced Technology Center, Buffalo, N.Y.

DATA USE INVESTIGATIONS FOR APPLICATIONS EXPLORER MISSION A (HEAT CAPACITY MAPPING MISSION): HCMM'S ROLE IN STUDIES OF THE URBAN HEAT ISLAND, GREAT LAKES THERMAL PHENOMENA AND RADIOMETRIC CALIBRATION OF SATELLITE DATA

Final Report

John R. Schott, Principal Investigator and Edward W. Schimminger Jan. 1981 138 p refs Original contains color imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to "Attn: National Space Science Data Center"; non-domestic users send orders to "Attn: World Data Center A for Rockets and Satellites". HCMM

(Contract NAS5-24263)

(E81-10159; NASA-CR-164271; Calspan-6175-M-1) Avail: NTIS HC A07/MF A01 CSCL 05B

The utility of data from NASA's heat capacity mapping mission satellite for studies of the urban heat island, thermal phenomena in large lakes and radiometric calibration of satellite sensors was assessed. The data were found to be of significant value in all cases. Using HCMM data, the existence and microstructure of the heat island can be observed and associated with land cover within the urban complex. The formation and development of the thermal bar in the Great Lakes can be observed and quantitatively mapped using HCMM data. In addition, the thermal patterns observed can be associated with water quality variations observed both from other remote sensing platforms and in situ. The imaging radiometer on-board the HCMM satellite is shown to be calibratible to within about 1.1 C of actual surface temperatures. These findings, as well as the analytical procedures used in studying the HCMM data, are included. A.R.H.

N81-24497*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

EVALUATING LANDSAT WILDLAND CLASSIFICATION ACCURACIES

David L. Toll Aug. 1980 35 p refs

(Contract DI-14-16-0008-2160)

(NASA-TM-81993) Avail: NTIS HC A03/MF A01 CSCL 08B

Procedures to evaluate the accuracy of LANDSAT derived wildland cover classifications are described. The evaluation procedures include: (1) implementing a stratified random sample for obtaining unbiased verification data; (2) performing area by area comparisons between verification and LANDSAT data for both heterogeneous and homogeneous fields; (3) providing overall and individual classification accuracies with confidence limits; (4) displaying results within contingency tables for analysis of confusion between classes; and (5) quantifying the amount of information (bits/square kilometer) conveyed in the LANDSAT classification. E.A.K.

N81-24498*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SMMR SIMULATOR RADIATIVE TRANSFER CALIBRATION MODEL. 2: ALGORITHM DEVELOPMENT

Susan Link, C. Calhoon, and B. Krupp Dec. 1980 120 p refs (NASA-TM-80735) Avail: NTIS HC A06/MF A01 CSCL 14B

Passive microwave measurements performed from Earth orbit can be used to provide global data on a wide range of geophysical and meteorological phenomena. A Scanning Multichannel Microwave Radiometer (SMMR) is being flown on the Nimbus-G satellite. The SMMR Simulator duplicates the frequency bands utilized in the spacecraft instruments through an amalgamate of radiometer systems. The algorithm developed utilizes data from the fall 1978 NASA CV-990 Nimbus-G underflight test series and subsequent laboratory testing. T.M.

N81-24499*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

EARTH SURVEY APPLICATIONS DIVISION Reasearch Report, 1980

Lloyd Carpenter, ed. Jan. 1981 355 p refs Submitted for publication

(NASA-TM-82071) Avail: NTIS HC A16/MF A01 CSCL 05B

Accomplishments of research and data analysis conducted to study physical parameters and processes inside the Earth and on the Earth's surface, to define techniques and systems for remotely sensing the processes and measuring the parameters of scientific and applications interest, and the transfer of promising operational applications techniques to the user community of Earth resources monitors, managers, and decision makers are described. Research areas covered include: geobotany, magnetic field modeling, crustal studies, crustal dynamics, sea surface topography, land resources, remote sensing of vegetation and soils, and hydrological sciences. Major accomplishments include: production of global maps of magnetic anomalies using Magsat data; computation of the global mean sea surface using GEOS-3 and Seasat altimetry data; delineation of the effects of topography on the interpretation of remotely-sensed data; application of snowmelt runoff models to water resources management; and mapping of snow depth over wheat growing areas using Nimbus microwave data. J.M.S.

N81-24500*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A NOTE ON SOLAR ELEVATION DEPENDENCE OF CLEAR SKY SNOW ALBEDO

B. J. Choudhury Feb. 1981 9 p refs Submitted for publication

(NASA-TM-82091) Avail: NTIS HC A02/MF A01 CSCL 08L

Recent attempts to match shortwave albedo of snow for clear skies using approximate spectral solar fluxes and solutions of the radiative transfer equation for snow were unsuccessful until a separate surface reflection term was introduced. A separate consideration of specular reflection from surface snow grains has been objected to as being ad hoc. Results based on a new parameterization of shortwave radiation are discussed. Compared to the previous radiation models, new model gives higher diffuse insolation and predicts higher albedos. The difference between observed and predicted albedos is substantially reduced without invoking surface reflection. Author

N81-24501*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

RELATIONSHIPS BETWEEN DIFFUSE REFLECTANCE AND VEGETATION CANOPY VARIABLES BASED ON THE RADIATIVE TRANSFER THEORY

John K. Park and Donald W. Deering Jan. 1981 24 p refs Presented at the ASP-ACSM Ann. Conv., Washington, D.C., 22-27 Feb. 1981

(NASA-TM-82067) Avail: NTIS HC A02/MF A01 CSCL 20F

Out of the lengthy original expression of the diffuse reflectance formula, simple working equations were derived by employing characteristic parameters, which are independent of the canopy coverage and identifiable by field observations. The typical asymptotic nature of reflectance data that is usually observed in biomass studies was clearly explained. The usefulness of the simplified equations was demonstrated by the exceptionally close fit of the theoretical curves to two separately acquired data sets for alfalfa and shortgrass prairie canopies. T.M.

N81-24502*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

CHANGES IN VEGETATION SPECTRA WITH DETERIORATION OF LEAVES UNDER TWO METHODS OF PRESERVATION

M. L. Labovitz, E. J. Masuoka, and S. G. Feldmann Jan. 1981 31 p refs

(NASA-TM-82068) Avail: NTIS HC A03/MF A01 CSCL 02C

An experiment to measure changes in leaf spectra under different methods of preservation over time was conducted. The

spectral measurements were made by a three band hand held radiometer which simulated three Thematic Mapper (TM) bands: TM3, TM4, and TM5. Daily spectral measurements of white oak leaves under three preservation treatments were made. The spectral readings over three treatments (fresh, bottled, and bagged vegetation) were indistinguishable in bands TM3 and TM5 for up to 4 days after collection. After that time bagged and bottled samples showed significant increases in reflected energy caused by loss of chlorophyll from and dehydration of the vegetation. No significant variation in the reflectance values from TM4 over preservation type for the experimental period was observed. E.A.K.

N81-24503*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

EARTH'S GRAVITY FIELD MAPPING REQUIREMENTS AND CONCEPT

F. O. Vonbun and W. D. Kahn Feb. 1981 23 p refs Submitted for publication

(NASA-TM-81996) Avail: NTIS HC A02/MF A01 CSCL 08B

A future sensor is considered for mapping the Earth's gravity field to meet future scientific and practical requirements for earth and oceanic dynamics. These are approximately + or - 0.1 to 10 mgal over a block size of about 50 km and over land and an ocean geoid to 1 to 2 cm over a distance of about 50 km. To achieve these values requires a gravity gradiometer with a sensitivity of approximately 10 to the -4 power EU in a circular polar orbiting spacecraft with an orbital altitude ranging 160 km to 180 km. Author

N81-24504*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

REMOTE SENSING OF PRECIPITABLE WATER OVER THE OCEANS FROM NIMBUS-7 MICROWAVE MEASUREMENTS

C. Prabhakara, H. D. Change (Computer Sciences Corp., Silver Spring, Md.), and A. T. C. Chang Apr. 1981 29 p refs

(NASA-TM-82117) Avail: NTIS HC A03/MF A01 CSCL 08C

Global maps of precipitable water over derived from scanning multichannel microwave radiometer (SMMR) data reveal salient features associated with ocean currents and the large scale general circulation in the atmosphere. Nimbus-7 SMMR brightness temperature measurements in the 21 and 18 GHz channels are used to sense the precipitable water in the atmospheric over oceans. The difference in the brightness temperature (T sub 21 -T sub 18), both in the horizontal and vertical polarization, is found to be essentially a function of the precipitable water in the atmosphere. An equation, based on the physical consideration of the radiative transfer in the microwave region, is developed to relate the precipitable water to (T sub 21 - T sub 18). It shows that the signal (T sub 21- T sub 18) does not suffer severely from the noise introduced by variations in the sea surface temperature, surface winds, and liquid water content in non rain clouds. The rms deviation between the estimated precipitable water from SMMR data and that given by the closely coincident ship radiosondes is about 0.25 g/ sq cm. E.A.K.

N81-24505*# University of South Florida, Tampa.

STOCHASTIC ANALYSIS OF MULTIPLE-PASSBAND SPECTRAL CLASSIFICATIONS SYSTEMS AFFECTED BY OBSERVATION ERRORS

Chris P. Tsokos Dec. 1980 31 p

(Grant NAG1-9)

(NASA-CR-164366) Avail: NTIS HC A03/MF A01 CSCL 05B

The classification of targets viewed by a pushbroom type multiple band spectral scanner by algorithms suitable for implementation in high speed online digital circuits is considered. A class of algorithms suitable for use with a pipelined classifier is investigated through simulations based on observed data from agricultural targets. It is shown that time distribution of target types is an important determining factor in classification efficiency. E.A.K.

N81-24506*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

A MOVING BASELINE FOR EVALUATION OF ADVANCED COAL EXTRACTION SYSTEMS

Charles R. Bickerton and M. Dean Westerfield 15 Apr. 1981 180 p refs Sponsored by NASA and DOE

(NASA-CR-164363; JPL-Pub-81-31; DOE/ET-12548/5) Avail: NTIS HC A09/MF A01 CSCL 08I

Results from the initial effort to establish baseline economic performance comparators for a program whose intent is to define, develop, and demonstrate advanced systems suitable for coal resource extraction beyond the year 2000 are reported. Systems used were selected from contemporary coal mining technology and from conservation conjectures of year 2000 technology. The analysis was also based on a seam thickness of 6 ft. Therefore, the results are specific to the study systems and the selected seam extended to other seam thicknesses. J.M.S.

N81-24507# Department of Energy, Washington, D. C. Energy Information Administration.

US CRUDE OIL AND NATURAL GAS RESERVES, 1978 Annual Report

Sep. 1980 73 p refs

(DOE/EIA-0216/78) Avail: NTIS HC A04/MF A01

Analysis of data filed by operators of domestic oil and gas wells on Form EIA-23, Annual Survey of Domestic Oil and Gas Reserves, indicates that as of December 31, 1978, the United States proved reserves of crude oil were 31,355 million barrels excluding lease condensate and other natural gas liquids. Proved reserves of dry natural gas were 208,033 billion cubic feet, exclusive of gas contained in underground storage. These proved reserves estimates are associated with sampling errors of less than 0.8 percent at a 95 percent confidence level. Overall survey response rate was 98 percent. Comparison of 1978 annual production estimates from this survey, with production data tabulated earlier by the EIA from state sources, indicates no significant undercoverage of the Form EIA-23 survey frame.DOE

N81-24508# Colorado School of Mines, Golden. Dept. of Chemical and Petroleum Refining Engineering.

ROLE OF SPENT SHALE IN OIL SHALE PROCESSING AND THE MANAGEMENT OF ENVIRONMENTAL RESIDUES Final Technical Report, Jan. 1979 - May 1980

Anthony L. Hines 15 Aug. 1980 154 p refs

(Contract DE-AC20-79LC-10020)

(DOE/LETC-10020/1) Avail: NTIS HC A08/MF A01

The adsorption of hydrogen sulfide on retorted oil shale was studied at 10, 25, and 60 C using a packed bed method. Equilibrium isotherms were calculated from the adsorption data and were modeled by the Langmuir, Freundlich, and Polanyi equations. The isoteric heat of adsorption was calculated at three adsorbent loadings and was found to increase with increased loading. A calculated heat of adsorption less than the heat of condensation indicated that the adsorption was primarily due to Van der Waals' forces. Adsorption capacities were also found as a function of oil shale retorting temperature with the maximum uptake occurring on shale that was retorted at 750 C. DOE

N81-24509# New Mexico Inst. of Mining and Technology, Socorro. Petroleum Recovery Research Center.

DEVELOPMENT OF MOBILITY CONTROL METHODS TO IMPROVE OIL RECOVERY BY CO2 Annual Report, 1 Oct. 1979 - 30 Sep. 1980

John P. Heller and Joseph J. Taber Mar. 1981 33 p refs

(Contract DE-AC21-79MC-10689)

(DOE/MC-10689/5; AR-1) Avail: NTIS HC A03/MF A01

Topics include the fundamental mechanisms of displacement and displacement instability in porous media, field tests and laboratory experiments on CO2 flooding, and the methods which were proposed to alleviate the low sweep efficiency caused by unfavorable mobility ratio. These suggested methods were grouped into three categories of mobility control procedures. They all involve the reduction of the displacing fluid mobility. The first of the three methods is called Water Alternated with Gas, or WAG for short. A second method which was proposed for mobility control is the use of foam - a dispersion of gas or solvent in water. Several early studies demonstrated the marked increase in flow resistance when the rock contained such a surfactant-stabilized dispersion. The third proposed mobility control method is the use of thickeners. DOE

N81-24510# National Petroleum Council, Washington, D. C.
UNCONVENTIONAL GAS SOURCES, EXECUTIVE SUMMARY
Dec. 1980 50 p
(DOE/TIC-11417) Avail: NTIS HC A03/MF A01

The long lead time required for conversion from oil or gas to coal and for development of a synthetic fuel industry dictates that oil and gas must continue to supply the United States with the majority of its energy requirements over the near term. In the interim period, the nation must seek a resource that can be developed quickly, incrementally, and with as few environmental concerns as possible. One option which could potentially fit these requirements is to explore for, drill, and produce unconventional gas; Devonian Shale gas, coal seam gas, gas dissolved in geopressured brines, and gas from tight reservoirs. The significance of these sources and the economic and technical conditions under which they could be developed are addressed. DOE

N81-24511# Northern Cheyenne Research Project, Lame Deer, Mont.
HYDROLOGIC IMPACTS FROM POTENTIAL COAL STRIP MINING: NORTHERN CHEYENNE RESERVATION, VOLUME 1 Final Report, Jun. 1975 - Dec. 1979
William W. Woessner, Edward L. Heffern, Charles Andrews, Thomas J. Osborne, Jason Whiteman, Wesley SpottedElk, and Daniel Morales-Brink Feb. 1981 322 p refs
(Grant EPA-R-803566)
(PB81-155061; EPA-600/7-81-004A-Vol-1) Avail: NTIS HC A14/MF A01 CSCL 08H

Data from surface water monitoring, groundwater monitoring, and geologic profiles is combined to estimate potential disruptions from future coal mine development on the reservation. The data is also a technical and planning guide to the geology and water resources of the reservation. GRA

N81-24512# Bendix Field Engineering Corp., Grand Junction, Colo.
STATISTICAL TECHNIQUES APPLIED TO AERIAL RADIOMETRIC SURVEYS (STAARS): PRINCIPAL COMPONENTS ANALYSIS USER'S MANUAL
C. D Koch, F. L. Pirkle, and J. S. Schmidt Jan. 1981 76 p refs
(Contract DE-AC13-76GJ-01664)
(GJBX-9-81) Avail: NTIS HC A05/MF A01

The variations exhibited by these data were reduced and classified into a number of linear combinations by using the PCA program. The PCA program then generates histograms and outlier maps of the individual variates. Black and white plots can be made on a Calcomp plotter by the application of follow-up programs. All programs referred to in this guide were written for a DEC-10. From this analysis a geologist may begin to interpret the data structure. Insight into geological processes underlying the data may be obtained. DOE

N81-24513# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
STUDY ON THE ELECTRONIC IMAGING SYSTEM MOMS IN THE REFLECTED AND THERMAL INFRARED SPECTRUM Final Report
Bernd Kunkel Bonn Bundesministerium fuer Forschung und Technologie Sep. 1980 105 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-80-026; ISSN-0170-1339) Avail: NTIS HC A06/MF A01

A modular optoelectronic multispectral scanner (MOMS) was designed and developed for ESA-LASS orbit requirements. The sensor modules for the spectral channels 1.55 to 1.75 microns, 2.08 to 2.30 microns, and 10 to 12 microns are centered on. The MOMS missions and sensor specifications are briefly summarized. Concepts for the linear IR detector arrays, the optics, and for the signal readout electronics are compared. A breadboard model, incorporating a 'common module' HgCdTe array with 180 detectors and parallel serial digital data output is defined on the component level. Author (ESA)

N81-24514# Environmental Monitoring and Support Lab., Las Vegas, Nev. Office of Research and Development.
PHYTOPLANKTON WATER-QUALITY RELATIONSHIPS IN U.S. LAKES. PART 8: ALGAE ASSOCIATED WITH OR RESPONSIBLE FOR WATER-QUALITY PROBLEMS
W. D. Taylor, L. R. Williams, S. C. Hern, V. W. Lambou, F. A. Morris (Nevada Univ., Las Vegas), M. K. Morris (Nevada Univ., Las Vegas), and C. L. Howard Dec. 1980 325 p refs
(PB81-150831; EPA-600/3-80-100-Pt-8) Avail: NTIS HC A14/MF A01 CSCL 06C

Environmental data are presented for 117 species and 24 genera of freshwater algae that are associated with or are responsible for water quality problems. The environmental data are based upon algal occurrence records from 250 lakes sampled in eastern and southeastern States. The water quality problems addressed include eutrophication, organic pollution, taste and odor, filter clogging, toxicity, and aesthetic nuisance. Data presented illustrate that most genera and species associated with eutrophic conditions also occur in nutrient poor waters, thus limiting their indicator value with respect to nutrient enrichment. GRA

N81-24515# Environmental Protection Agency, Research Triangle Park, N.C. Large Lakes Research Station.
RESPONSE OF SAGINAW BAY, LAKE HURON, TO REDUCTIONS IN PHOSPHORUS LOADINGS FROM THE SAGINAW RIVER
Victor J. Bierman, Jr. and David M. Dolan Dec. 1980 87 p refs Prepared for IJC, Washington, D.C.
(PB81-150955; EPA-600/3-80-099) Avail: NTIS HC A05/MF A01 CSCL 13B

Results of phosphorus load reductions are presented for parameters that relate most directly to the water quality issues in Saginaw Bay. These parameters include taste and odor in the municipal water supply, and annual average total phosphorus concentration. Results are also presented for total phytoplankton biomass and total blue-green phytoplankton biomass. GRA

N81-24516# Cooper Union, New York.
CORRELATION OF MATHEMATICAL MODELS FOR WATER TEMPERATURE WITH AERIAL INFRARED WATER TEMPERATURE SURVEYS AND INVESTIGATION OF THERMAL FRONTS Final Report, Jun. 1978 - Aug. 1979
J. C. Cataldo and A. S. Goodman Aug. 1979 124 p refs Prepared in cooperation with Polytechnic Inst. of New York
(PB81-151490; NYSERDA-79-9) Avail: NTIS HC A06/MF A01 CSCL 13B

Two mathematical models were developed to predict the behavior and activity of thermal plumes formed when power plants discharge heated water. The first model employs surface temperature data from infrared pictures of a thermal plume. Based on this data the model can be used to determine the three dimensional configuration of a thermal plume. Predicted configurations were found to be extremely accurate when compared to actual field data. GRA

N81-24517# Soil Conservation Service, Washington, D. C. Engineering Div.
WATERSHED AND STREAM MECHANICS Final Report
Mar. 1980 856 p refs
(PB81-152399) Avail: NTIS HC A99/MF A01 CSCL 13B

Notes for a training course on stream mechanics provide an awareness and understanding of the basic principles of watershed and river hydraulics and the dynamic boundary response. Principles of stream dynamic of both rigid boundary and alluvial (moveable bed) channels are presented, quantitative procedures for analysis of channel modification, etc. The dynamics of stream systems considering geologic, hydrologic, and hydraulic perspectives are reviewed. GRA

N81-24518# National Science Foundation, Washington, D. C. Div. of Problem Focused Research.
DEEP MINERAL RESOURCES, CURRENT RESEARCH PROJECTS SUPPORTED BY THE INTEGRATED BASIS RESEARCH PROGRAM
Jack T. Sanderson, Donald Senich, Lewis G. Mayfield, and Ritchie B. Coryell Mar. 1980 34 p
(PB81-148090; NSF/RA-800327) Avail: NTIS HC A03/MF A01 CSCL 08I

The status of basic research projects dealing with the origins of ore deposits, mineral exploration and extraction of mineral

values by in situ leaching (solution mining), is summarized. Mining by in situ methods is a promising means of mineral extraction which offers a significant improvement in miner safety and reduced disturbance of the surface environment. These methods involve injecting leaching solutions into a deep ore body where they react chemically with minerals. Dissolved minerals then flow to the surface via production wells where the metals are recovered by hydrometallurgical processes. Projects reported include solution mining; solution chemistry and rock mechanics; and mineral exploration science-geodynamics, metallogenesis, deep basement and upper mantle investigations; and exploration methods. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N81-24519* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HEAT EXCHANGER AND METHOD OF MAKING Patent
Anthony Fortini and John M. Kazaroff, inventors (to NASA) Issued 20 Jan. 1981 5 p Filed 23 Apr. 1979 Supersedes N79-23383 (17 - 14, p 1850) Division of US Patent Appl. SN-856462, US Patent-4,199,937, filed 30 Nov. 1977
(NASA-Case-LEW-12441-3; US-Patent-4,245,469; US-Patent-Appl-SN-032307; US-Patent-Class-60-204; US-Patent-Class-60-267; US-Patent-Class-239-127.1; US-Patent-4,199,937; US-Patent-Appl-SN-856462) Avail: US Patent and Trademark Office CSCL 10B

A heat exchanger of increased effectiveness is disclosed. A porous metal matrix is disposed in a metal chamber or between walls through which a heat transfer fluid is directed. The porous metal matrix has internal bonds and is bonded to the chamber in order to remove all thermal contact resistance within the composite structure. Utilization of the invention in a rocket chamber is disclosed as a specific use. Also disclosed is a method of constructing the heat exchanger.
Official Gazette of the U.S. Patent and Trademark Office

N81-24520* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLAR TRACKING SYSTEM Patent
Paul R. White and Donald R. Scott, inventors (to NASA) Issued 14 Apr. 1981 6 p Filed 25 Jul. 1979 Supersedes N79-28667 (17 - 19, p 2567)
(NASA-Case-MFS-23999-1; US-Patent-4,262,195; US-Patent-Appl-SN-060435; US-Patent-Class-250-203R; US-Patent-Class-250-209) Avail: US Patent and Trademark Office CSCL 10A

A solar tracker for a solar collector is described in detail. The collector is angularly oriented by a motor wherein the outputs of two side-by-side photodetectors are discriminated as to three ranges: a first corresponding to a low light or darkness condition; a second corresponding to light intensity lying in an intermediate range; and a third corresponding to light above an intermediate range, direct sunlight. The first output drives the motor to a selected maximum easterly angular position; the second enables the motor to be driven westerly at the Earth rotational rate; and the third output, the separate outputs of the two photodetectors, differentially controls the direction of rotation of the motor to effect actual tracking of the Sun.
Official Gazette of the U.S. Patent and Trademark Office

N81-24521* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TOROIDAL CELL AND BATTERY Patent
William J. Nagle, inventor (to NASA) Issued 14 Apr. 1981 7 p Filed 28 Mar. 1980 Supersedes N80-33857 (18 - 24, p 3299)
(NASA-Case-LEW-12918-1; US-Patent-4,262,064; US-Patent-Appl-SN-134855; US-Patent-Class-429-94; US-Patent-Class-429-120; US-Patent-Class-429-160; US-Patent-Class-429-164) Avail: US Patent and Trademark Office CSCL 10C

A toroidal storage battery designed to handle relatively high amp-hour loads is described. The cell includes a wound core disposed within a pair of toroidal channel shaped electrodes spaced apart by nylon insulator. The shape of the case electrodes of this toroidal cell allows a first planar doughnut shaped surface and the inner cylindrical case wall to be used as a first electrode and a second planar doughnut shaped surface and the outer cylindrical case wall to be used as a second electrode. Connectors may be used to stack two or more toroidal cells together by connecting substantially the entire surface area of the first electrode of a first cell to substantially the entire surface area of the second electrode of a second cell. The central cavity of each toroidal cell may be used as a conduit for pumping a fluid through the toroidal cell to thereby cool the cell.
Official Gazette of the U.S. Patent and Trademark Office

N81-24522 Carnegie-Mellon Univ., Pittsburgh, Pa.
DYNAMIC MODELING OF LOW THERMAL GRADIENT EVAPORATORS AND CONDENSERS Ph.D. Thesis
Morteza Mokhtarzadeh 1980 112 p
Avail: Univ. Microfilms Order No. 8107883

The transient behavior of different types of heat exchangers proposed for ocean thermal energy conversion (OTEC) is discussed. Models are developed for both shell-tube condensers and evaporators and for two phase flow systems. Two numerical techniques for the simulation of distributed parameter systems which arise in heat exchanger modeling are investigated: classic finite difference methods and the more recent delay dissipation (sometimes called sine photography) approach. Frequency response analysis is used to compare the two simulation methods. The resultant heat exchanger models give the dynamic response of ammonia pressure (output of the model) to changes in ammonia vapor flow rate (input). An OTEC power cycle is molded so that different heat exchangers may be plugged in and their transient behavior analyzed. The dynamic stability of the OTEC power plant for all heat exchangers analyzed in this work (falling film, pool boiling and two phase flow system) is confirmed.
Dissert. Abstr.

N81-24523 Minnesota Univ., Minneapolis.
AN INVESTIGATION OF THE CONTOURED-OXIDE MONOLITHIC SERIES-ARRAY SOLAR BATTERY Ph.D. Thesis
Eileen Marie Murray 1980 86 p
Avail: Univ. Microfilms Order No. 8109479

The contoured-oxide monolithic series-array solar battery (MSASB) uses dielectric isolation to separate the individual cells of the array which offers an improvement in cell response uniformity over previous MSASB designs. The devices discussed exhibited array power conversion efficiencies of 7.5 percent which was attributed in part to high series resistance caused by a process omission. In addition, it was determined that shunting due to poor device isolation was a problem. Modifications to this process for improved array response are detailed and array optimization for maximum output power is analyzed. The loss mechanisms are considered. Area losses are composed of interconnect area, area shaded by front-grid contacts and area devoted to any needed circuitry. An evaluation of this problem, yielding the optimum number of cells, is presented.
Dissert. Abstr.

N81-24524 Utah Univ., Salt Lake City.
INVESTIGATION OF SALT STRATIFIED SOLAR POND OPERATIONAL CHARACTERISTICS Ph.D. Thesis
Ty Allan Newell 1980 245 p
Avail: Univ. Microfilms Order No. 8109565

Operational characteristics and economic feasibility of the salt stratified solar pond are examined. A one dimensional transient numerical model is developed which offers flexibility for pond property specifications, thermal energy performance prediction, and thermal energy extraction uses. Stability of the gradient zone of a salt stratified pond is one of the most important

areas of pond operational feasibility. A criterion for the operational state of a solar pond which constrains the allowable salinity and temperature profiles is developed and extended for use as a design tool for solar ponds. The decanting method of thermal energy extraction is most feasible for large scale ponds. A two dimensional numerical fluid dynamics program has been developed for this purpose and examines the effect of inlet and outlet jet placement in the storage zone of a pond. A simple laboratory experiment for qualitative investigations of solar pond phenomena is described. Dissert. Abstr.

N81-24525*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HEAT PIPE COOLED PROBE Patent Application
Charles J. Camarda and Lana M. Couch, inventors (to NASA) Filed 13 Feb. 1981 10 p
(NASA-Case-LAR-12588-1; US-Patent-Appl-SN-234222) Avail: NTIS HC A02/MF A01 CSCL 10A

The basic heat pipe principle is employed to provide a self-contained passively cooled probe that may be placed into a high temperature environment. The probe consists of an evaporator region of a heat pipe and a sensing instrument. Heat is absorbed as the working fluid evaporates in the probe. The vapor is transported to the vapor space of the condenser region. Heat is dissipated from the condenser region and fins causing condensation of the working fluid, which returns to the probe by gravity and the capillary action of the wick. Working fluid, wick and condenser configurations, and structural materials can be selected to maintain the probe within an acceptable temperature range. NASA

N81-24526*# Arizona State Univ., Tempe.
WORK FUNCTION DETERMINATION OF PROMISING MATERIAL FOR THERMIONIC CONVERTERS Final Report
M. H. Jacobs and Dean Jacobson 1980 24 p refs Sponsored by NASA Prepared for JPL
(Contracts NAS7-100; JPL-955054)
(NASA-CR-164368; ERC-R-7903; JPL-9950-467) Avail: NTIS HC A02/MF A01 CSCL 10A

The work done to fabricate Marchuk plasma discharge tubes for measurement of the cesiated emission of lanthanum hexaboride and thoriated tungsten electrodes is described. A photon counting pyrometer was completed and is to be calibrated with a gold standard. T.M.

N81-24527*# Union Carbide Corp., New York.
LOW COST SOLAR ARRAY PROJECT: EXPERIMENTAL PROCESS SYSTEM DEVELOPMENT UNIT FOR PRODUCING SEMICONDUCTOR-GRADE SILICON USING SILANE-TO-SILICON PROCESS Quarterly Progress Report, Oct. - Dec. 1980
Dec. 1980 109 p refs Sponsored by DOE Prepared for JPL
(Contract JPL-954334)
(NASA-CR-164342; DOE/JPL-954334-17; JPL-9950-531) Avail: NTIS HC A06/MF A01 CSCL 10A

The design, fabrication, and installation of an experimental process system development unit (EPSDU) were analyzed. Supporting research and development were performed to provide an information data base usable for the EPSDU and for technological design and economical analysis for potential scale-up of the process. Iterative economic analyses were conducted for the estimated product cost for the production of semiconductor grade silicon in a facility capable of producing 1000-MT/Yr. R.C.T.

N81-24528*# Thermo Electron Corp., Waltham, Mass.
NASA-OAST/JPL HIGH EFFICIENCY THERMIONIC CONVERSION STUDIES Executive Summary Report
Mar. 1981 57 p refs Prepared for JPL
(Contract JPL-955009)
(NASA-CR-164343; TE4247-193-81; JPL-9950-539) Avail: NTIS HC A04/MF A01 CSCL 10A

Efforts were made to develop a thermionic energy conversion TEC technology appropriate for nuclear electric propulsion missions. This space TEC effort was complementary to the terrestrial TEC studies sponsored by the Department of Energy which had the goal of topping fossil fuel power plants. Thermionic energy conversion was a primary conversion option for space reactors because of its: (1) high operating temperature; (2) lack of moving parts; (3) modularity; (4) established technology; and (5) development potential. R.C.T.

N81-24529*# Reifer Consultants, Inc., Torrance, Calif.
ANALYSIS OF DSN SOFTWARE ANOMALIES Final Report
D. D. Galorath, H. Hecht (SoHaR, Inc.), M. Hecht (SoHaR, Inc.), and D. J. Reifer 27 Feb. 1981 96 p refs Sponsored by NASA Prepared for JPL
(NASA-CR-164369; JPL-9950-536; RCI-TR-005; LO-726925) Avail: NTIS HC A05/MF A01 CSCL 10A

A categorized data base of software errors which were discovered during the various stages of development and operational use of the Deep Space Network DSN/Mark 3 System was developed. A study team identified several existing error classification schemes (taxonomies), prepared a detailed annotated bibliography of the error taxonomy literature, and produced a new classification scheme which was tuned to the DSN anomaly reporting system and encapsulated the work of others. Based upon the DSN/RCI error taxonomy, error data on approximately 1000 reported DSN/Mark 3 anomalies were analyzed, interpreted and classified. Next, error data are summarized and histograms were produced highlighting key tendencies. T.M.

N81-24530*# DHR, Inc., Washington, D.C.
MARKET ASSESSMENT OF PHOTOVOLTAIC POWER SYSTEMS FOR AGRICULTURAL APPLICATIONS IN THE PHILIPPINES Final Report
R. Anil Cabraal, David Delasanta, and George Burrill (Associates in Rural Development, Inc., Burlington, Vt.) Apr. 1981 205 p refs
(Contract DEN3-180; DE-AI01-79ET-20485)
(NASA-CR-165286; DOE/NASA/0180-1; C4100-50) Avail: NTIS HC A10/MF A01 CSCL 10A

The market potential in the Philippines for stand alone photovoltaic (P/V) systems in agriculture was assessed. Applications include: irrigation, postharvest operation, food and fiber processing and storage, and livestock and fisheries operations. Power and energy use profiles for many applications as well as assessments of business, government and financial climate for P/V sales are described. Many characteristics of the Philippine agriculture and energy sector favorably influence the use of P/V systems. However, serious and significant barriers prevent achieving the technically feasible, cost competitive market for P/V systems in the agricultural sector. The reason for the small market is the limited availability capital for financing P/V systems. It is suggested that innovative financing schemes and promotional campaigns should be devised. E.A.K.

N81-24531*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM ECONOMIC EVALUATION: IBM SYSTEM 4, CLINTON, MISSISSIPPI Final Report
Sep. 1980 101 p refs
(Contract NAS8-32036)
(NASA-CR-161726) Avail: NTIS HC A06/MF A01 CSCL 10A

An economic analysis of the solar energy system was developed for five sites, typical of a wide range of environmental and economic conditions in the continental United States. The analysis was based on the technical and economic models in the F-chart design procedure, with inputs based on the characteristic of the installed system and local conditions. The results are of the economic parameters of present worth of system cost over a 20 year time span: life cycle savings, year of positive savings and year of payback for the optimized solar energy system at each of the analysis sites. The sensitivity of the economic evaluation to uncertainties in constituent system and economic variables is also investigated. E.A.K.

N81-24532*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM ECONOMIC EVALUATION: FERN TUNKHANNOCK, TUNKHANNOCK, PENNSYLVANIA Final Report
Sep. 1980 99 p refs
(Contract NAS8-32036)
(NASA-CR-161723) Avail: NTIS HC A05/MF A01 CSCL 10A

Economic performance of an Operational Test Site (OTS) is described. The long term economic performance of the system at its installation site and extrapolation to four additional selected locations to demonstrate the viability of the design over a broad range of environmental and economic conditions is reported. Topics discussed are: system description, study approach, economic analysis and system optimization, and technical and economical results of analysis. Data for the economic analysis are generated through evaluation of the OTS. The simulation is based on the technical results of the seasonal report simulation. In addition localized and standard economic parameters are used for economic analysis. E.A.K.

N81-24533*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECTS OF FUEL-INJECTOR DESIGN ON ULTRA-LEAN COMBUSTION PERFORMANCE

David N. Anderson 1981 14 p refs Proposed for presentation at the 16th Intersoc. Energy Conversion Eng. Conf., Atlanta, 9-14 Aug. 1981

(Contract DE-A101-77CS-51040)

(NASA-TM-82624; DOE/NASA/51040-26; E-877) Avail: NTIS HC A02/MF A01 CSCL 10A

Emissions data were obtained for six fuel injector configurations tested with ultra lean combustion. Fuel injectors included three multiple source designs and three configurations using a single air assist injector. Only the multiple source fuel injectors provided acceptable emissions. Values of 16g CO/kg fuel, 1.9g HC/kg fuel, and 19.g NO2/kg fuel were obtained for the combustion temperature range of 1450 to 1700 K for both a high blockage 19 source injector and a low blockage 41 source injector. It was shown that high fuel injector pressure drop may not be required to achieve low emissions performance at high inlet air temperature when the fuel is well dispersed in the airstream. E.A.K.

N81-24534*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

NASA PREPROTOTYPE REDOX STORAGE SYSTEM FOR A PHOTOVOLTAIC STAND-ALONE APPLICATION

Norman H. Hagedorn 1981 13 p To be presented at the Intersociety Energy Conversion Eng. Conf., Atlanta, 9-14 Aug. 1981; sponsored by ASME

(NASA-TM-82607; DOE/NASA/12726-8; E-854) Avail: NTIS HC A02/MF A01 CSCL 10C

A 1 kW preprototype redox storage system underwent characterization tests and was operated as the storage device for a 5 kW (peak) photovoltaic array. The system is described and performance data are presented. Loss mechanisms are discussed and simple design changes leading to significant increases in efficiency are suggested. The effects on system performance of nonequilibrium between the predominant species of complexed chromic ion in the negative electrode reactant solution are indicated. Author

N81-24535*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

TEST EVALUATION OF A LAMINATED WOOD WIND TURBINE BLADE CONCEPT Final Report

James R. Faddooul May 1961 48 p refs

(Contract DE-AI01-76ET-20320)

(NASA-TM-81719; DOE/NASA/20320-30; E-753) Avail: NTIS HC A03/MF A01 CSCL 10B

A series of tests conducted on a root end section of a laminated wood wind turbine blade are reported. The blade to hub transition of the wood blade uses steel studs cast into the wood D spar with a filled epoxy. Both individual studs and a full scale, short length, root section were tested. Results indicate that the bonded stud concept is more than adequate for both the 30 year life fatigue loads and for the high wind or hurricane gust loads. E.A.K.

N81-24536*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

LABORATORY EVALUATION OF A PILOT CELL BATTERY PROTECTION SYSTEM FOR PHOTOVOLTAIC APPLICATIONS

Robert L. Cataldo and Ralph D. Thomas 1981 14 p refs Proposed for presentation at the 16th Intersoc. Energy Conversion Eng. Conf., Atlanta, 9-14 Aug. 1981

(Contract DE-AI01-79ET-20485)

(NASA-TM-81714; DOE/NASA/20485-7; E-747) Avail: NTIS HC A02/MF A01 CSCL 10C

An energy storage method for the 3.5 kW battery power system was investigated. The Pilot Cell Battery Protection System was tested for use in photovoltaic power systems and results show that this is a viable method of storage battery control. The method of limiting battery depth of discharge has the following advantages: (1) temperature sensitivity; (2) rate sensitivity; and (3) state of charge indication. The pilot cell concept is of interest in remote stand alone photovoltaic power systems. The battery can be protected from damaging overdischarge by using the proper ratio of pilot cell capacities to main battery capacity. E.A.K.

N81-24537*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SENSITIVITY ANALYSIS OF THE ADD-ON PRICE ESTIMATE FOR THE EDGE-DEFINED FILM-FED GROWTH PROCESS

Anant R. Mokashi and Akaram H. Kachare 15 Mar. 1981 36 p refs Sponsored by NASA Prepared for DOE

(JPL Proj. 5101-171)

(NASA-CR-164358; JPL-Pub-81-37; DOE/JPL-1012-55) Avail: NTIS HC A03/MF A01 CSCL 10A

The analysis is in terms of cost parameters and production parameters. The cost parameters include equipment, space, direct labor, materials, and utilities. The production parameters include growth rate, process yield, and duty cycle. A computer program was developed specifically to do the sensitivity analysis. T.M.

N81-24538*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

HIGH-EFFICIENCY THIN-FILM GaAs SOLAR CELLS, PHASE 2 Final Report, 1 Jul. 1979 - 30 Jan. 1981

Y. C. M. Yeh 15 Mar. 1981 101 p refs Sponsored by DOE

(NASA-CR-164361; JPL-Pub-81-33) Avail: NTIS HC A06/MF A01 CSCL 10A

Thin GaAs epi-layers with good crystallographic quality were grown using a (100) Si-substrate on which a thin Ge epi-interlayer was grown by CVD from germane. Both antireflection-coated metal oxide semiconductor (AMOS) and n(+)/p homojunction structures were studied. The AMOS cells were fabricated on undoped-GaAs epi-layers deposited on bulk poly-Ge substrates using organo-metallic CVD film-growth, with the best achieved AM1 conversion efficiency being 9.1%. Both p-type and n(+)-type GaAs growth were optimized using 50 ppm dimethyl zinc and 1% hydrogen sulfide, respectively. A direct GaAs deposition method in fabricating ultra-thin top layer, epitaxial n(+)/p shallow homojunction solar cells on (100) GaAs substrates (without anodic thinning) was developed to produce large area (1 sq/cm) cells, with 19.4% AM1 conversion efficiency achieved. Additionally, an AM1 conversion efficiency of 18.4% (17.5% with 5% grid coverage) was achieved for a single crystal GaAs n(+)/p cell grown by OM-CVD on a Ge wafer. J.M.S.

N81-24539*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

LIGHTNING ACCOMMODATION SYSTEMS FOR WIND TURBINE GENERATOR SAFETY

H. Bankaitis 1981 16 p refs Proposed for presentation at the 5th Intern. System Safety Conf., Denver, 26-31 Jul. 1981

(Contract DE-AI01-76ET-20320)

(NASA-TM-82601; DOE/NASA/20320-31; E-848) Avail: NTIS HC A02/MF A01 CSCL 10B

The wind turbine safety program identifies the naturally occurring lightning phenomenon as a hazard with the potential to cause loss of program objectives, injure personnel, damage system instrumentation, structure or support equipment and facilities. Several candidate methods of lightning accommodation for each blade were designed, analyzed, and tested by submitting sample blade sections to simulated lightning. Lightning accommodation systems for composite blades were individually developed. Their effectiveness was evaluated by submitting the systems to simulated lightning strikes. The test data were analyzed and system designs were reviewed on the basis of the analysis.

This activity is directed at defining design and procedural constraints, requirements for safety devices and warning methods, special procedures, protective equipment and personnel training. T.M.

N81-24540*# Spectrolab, Inc., Sylmar, Calif.
PILOT PRODUCTION AND TESTING OF HIGH EFFICIENCY WRAPAROUND CONTACT SOLAR CELLS Final Report, May 1979 - Mar. 1981
M. Gillanders Jun. 1981 44 p refs
(Contract NAS3-21270)
(NASA-CR-165302) Avail: NTIS HC A03/MF A01 CSCL 10A

Modifications were made to the process sequence until a device capable of high performance and satisfactory processing yields could be fabricated on a production line. Pilot production resulted in a 2 x 4 cm screen printed dielectric wraparound contact solar cell with average 28 C, Air Mass Zero (AMO) conversion efficiencies of 14.2% and reasonable process yields. This high performance was obtained with two different back contact configurations, making the device acceptable for many applications. T.M.

N81-24541*# International Business Machines Corp., Huntsville, Ala. Federal Systems Div.
SOLAR ENERGY SYSTEM ECONOMIC EVALUATION FOR IBM SYSTEM 3, GLENDO, WYOMING Final Report
Sep. 1980 102 p refs Sponsored in part by DOE
(Contract NAS8-32036)
(NASA-CR-161728) Avail: NTIS HC A06/MF A01 CSCL 10B

This analysis was based on the technical and economic models in f-chart design procedures with inputs based on the characteristics of the parameters of present worth of system cost over a projected twenty year life: life cycle savings, year of positive savings, and year of payback for the optimized solar energy system at each of the analysis sites. The sensitivity of the economic evaluation to uncertainties in constituent system and economic variables was also investigated. T.M.

N81-24542# Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
JET ENTRAINMENT IN PUMPED-STORAGE RESERVOIRS Final Report
Philip J. W. Roberts Mar. 1981 68 p refs
(Contract DACW39-79-M-2846)
(AD-A098156; WES-TR-E-81-3) Avail: NTIS HC A04/MF A01 CSCL 08/8

A literature review was made in order to recommend a mathematical model to predict jet entrainment in pumped-storage reservoirs. It was found that because of the many different types of inflow situations possible, no one mathematical model would be adequate in all cases. It is recommended that each flow situation be classified and entrainment be predicted for each situation by means of techniques presented in the report. The flows are classified according to the source geometry, source buoyancy, ambient stratification, and degree of submergence. A primary and secondary classification scheme resulted in 16 possible flow types. Each situation is reviewed separately and a method for predicting entrainment presented. To use the results, judgment must first be used to classify the flow under consideration and the appropriate technique for that class of flows used. If some of the flows discussed are prevalent or of particular interest, they could be investigated in more depth and mathematical models of those developed. Author (GRA)

N81-24543# Office of Naval Research, London (England).
CLIMATE AND OFFSHORE ENERGY RESOURCES
Paul F. Twitchell 30 Dec. 1980 11 p Presented at ONR Conf., London, 21-23 Oct. 1980
(AD-A097774; ONRL-C-13-80) Avail: NTIS HC A02/MF A01 CSCL 04/2

A conference discussed the relationship of climate to the world's offshore energy resources. The conference focused upon such areas as the impact of oil resources upon the economies of developed and developing countries, the importance of providing climatic data in sufficient time to meet users' needs, and the hazards and financial burdens associated with the development of offshore oil reserves. One of the important achievements of the confidence was the establishment of better communications between the users of environmental data and those charged with producing predictions. GRA

N81-24544# Naval Surface Weapons Center, White Oak, Md. Research and Technology Dept.
THE RELATION OF BATTERIES TO EXPLOSIVES
Carol Freeman Sep. 1980 23 p refs
(AD-A097822; NSWC/TR-80-455) Avail: NTIS HC A02/MF A01 CSCL 10/3

All batteries contain chemical materials which can be made to explode under certain conditions. This report defines applicable explosives terminology and discusses these definitions in terms of explosives, thermal runaway and fires associated with aqueous (Le Clanche, mercury, lead acid, nickel cadmium) and non-aqueous (lithium anode systems) batteries. Author (GRA)

N81-24545# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
SIMPLIFIED ANALYSIS OF COMPLEX CONDUCTIVITY DATA
Mark Salomon Mar. 1981 16 p refs
(DA Proj. 1L1-62705-AH-94)
(AD-A098277; DELET-TR-81-6) Avail: NTIS HC A02/MF A01 CSCL 10/3

A simplified method is presented for the analysis of conductivity data for complex situations which involve ion pairing. The method was tested by comparing results with more elaborate analyses using published data for a number of salts in various solvents. The method is then used to analyze the conductivity data for several salts in thionyl chloride. These latter analyses are important for selecting electrolytes for lithium primary batteries. Author (GRA)

N81-24546# Coast Guard Research and Development Center, Groton, Conn.
TESTING OF SOLAR PHOTOVOLTAIC ARRAYS FOR UTILIZATION ON MARINE AIDS TO NAVIGATION Interim Report
S. E. Trenchard Nov. 1980 72 p refs
(AD-A098257; CGR/DC-13/80; UACG-D-10-51) Avail: NTIS HC A04/MF A01 CSCL 10/2

In 1978, approximately 400 solar photovoltaic arrays were procured and placed at marine exposure facilities in Groton, Connecticut, and Fort Lauderdale, Florida. The arrays were measured quarterly to ascertain the effects of the marine environment on electrical performance. Concurrently, a screening test for photovoltaic arrays to be used in the marine environment was developed at the Coast Guard R and D Center. Identical panels to those on test at the exposure sites were run through the pressure, immersion, and temperature (PIT) screening test. Based on the marine environment exposure test and the PIT screening test, recommendations are made on the constituent materials and construction techniques of solar photovoltaic arrays that are most suited for use in the marine environment. Author (GRA)

N81-24547# Brobeck (William M.) and Associates, Berkeley, Calif.
REVIEW OF CURRENT STATUS OF HIGH FLUX HEAT TRANSFER TECHNIQUES. VOLUME 1: TEST AND APPENDIX A
A. Bauer, H. S. Gordon, H. Lackner, and J. R. Mettling Sep. 1980 164 p refs Prepared for California Univ., Livermore. Lawrence Livermore Lab.
(Contract W-7405-eng-48)
(UCRL-15321-Vol-1; WMB/A-4500-95-27.20-R1-Vol-1) Avail: NTIS HC A05/MF A01

High heat flux technology is reviewed with consideration given to heat transfer panel configuration, diagnostics techniques, and coolant supply. The technology offering the least uncertainty for scale up for the fusion energy research requirements is recommended. DOE

N81-24548# Rockwell International Corp., Anaheim, Calif. Electronic Devices Div.
THIN FILMS OF GALLIUM ARSENIDE ON LOW-COST

SUBSTRATES Final Technical Report, 5 Jul. 1976 - 5 Dec. 1978
R. P. Ruth, P. D. Dapkus, R. D. Dupuis, R. E. Johnson, L. A. Moudy, J. J. Yang, and R. D. Yingling Mar. 1980 104 p refs
(Contract DE-AC03-76ET-20435)
(SAN-1202-8) Avail: NTIS HC A06/MF A01

The metalorganic chemical vapor deposition (MO-CVD) technique was applied to the growth of thin films of GaAs and GaAlAs on inexpensive polycrystalline or amorphous substrate materials. The properties of grain boundaries in polycrystalline GaAs films were studied by the use of transport measurements as a function of temperature. Schottky barrier solar cells of approximately 3 percent efficiency were demonstrated on various substrates. Substantial enhancement of average grain size in polycrystalline GaAs films on Mo sheet was obtained. Investigation of polycrystalline thin-film p-n junctions indicated that the forward voltage of such devices is apparently limited to 0.5 to 0.6V. A laboratory-type deposition apparatus for the formation of TiO2 antireflection coatings was assembled and tested. Detailed analyses were made of the materials and labor costs involved in the laboratory-scale fabrication of MO-CVD thin-film GaAs solar cells. DOE

N81-24549# Department of Energy, Washington, D. C. Office of Program Coordination.
INVENTORY OF FEDERAL ENERGY-RELATED ENVIRONMENTAL AND SAFETY RESEARCH FOR FY 1979. VOLUME 1: EXECUTIVE SUMMARY
Dec. 1980 50 p refs
(DOE/EV-0057/2-Vol-1) Avail: NTIS HC A03/MF A01

Research and development (R and D) categories were reorganized into three main areas; environmental and safety control technology, technology impacts overview and assessments, and biological and environmental R and D and assessments. The inventory also breaks out research sponsored by various federal agencies and the amount of funding provided by each in various research categories. The format and index system allows efficient access to information compiled. Users are able to identify projects by log agency, performing organization, principal investigator and subject. DOE

N81-24550# Department of Energy, Washington, D. C. Office of Program Coordination.
INVENTORY OF FEDERAL ENERGY-RELATED ENVIRONMENT AND SAFETY RESEARCH FOR FY 1979. VOLUME 2: PROJECT LISTINGS AND INDEXES
Dec. 1980 694 p refs
(DOE/EV-0057/2-Vol-2) Avail: NTIS HC A99/MF A01

The research is arranged by log number, which groups the projects by reporting agency. The log number is a unique number assigned to each project from a block of numbers set aside for each contributing agency. Information elements included in the summary listings are project title, principal investigators, research organization, project number, contract number, supporting organization, funding level, related energy sources with numbers indicating percentages of effort devoted to each, and R and D categories. A brief description of each project is given, and this is followed by subject index terms that were assigned for computer searching and for generating the printed subject index. DOE

N81-24551# Wilson-Hill Associates, Inc., Washington, D.C.
BENCHMARK REQUIREMENTS FOR THE THE ENERGY EMERGENCY MANAGEMENT INFORMATION SYSTEM (EEMIS). PHASE 1: WORK PLAN
22 Sep. 1980 17 p
(Contract DE-AC01-80EI-11581)
(DOE/EIA-11581/T3) Avail: NTIS HC A02/MF A01

The energy emergency management information system (EEMIS) has responsibility for providing special information and communication services to government officials at Federal and state levels, who must deal with energy emergencies. Because of proprietary information residing in the data base used for federal purposes, a special system (EEMIS-S) must be established for use by the states. It is planned to acquire teleprocessing services for EEMIS-S from a time-sharing commercial vendor, and the process for procurement must meet guidelines for approval. The work plan and schedule for meeting these guidelines are discussed. Tasks to be included contain estimates of time, cost, and resources required, all of which are briefly described. DOE

N81-24552# Vetter Research, Costa Mesa, Calif.
PARTICLE CHARACTERIZATION FOR GEOTHERMAL OPERATIONS
O. J. Vetter and V. Kandarpa 6 Jan. 1981 50 p refs
(Contract DE-AC03-78ET-27146)
(DOE/ET-27146/T1; VR-81-01-06) Avail: NTIS HC A03/MF A01

A detailed summary of an ongoing evaluation of existing particle measuring methodology with emphasis on (1) adapting of existing methods in geothermal operations and (2) further development of existing instrumentation for field use is presented. The various instruments and methods used and/or suggested for particle characterization are described in detail. Theoretical and practical aspects of particle characterization are outlined. A plan for further laboratory and field experiments is outlined. DOE

N81-24553# Oak Ridge National Lab., Tenn. Chemical Technology Div.
MODELING SOLID HYDROGEN STORAGE BEDS
P. W. Fisher and J. S. Watson Mar. 1981 37 p refs
(Contract W-7405-ENG-26)
(ORNL/TM-7561) Avail: NTIS HC A03/MF A01

The relative importance of heat transfer, mass transfer, chemical kinetics, and equilibrium were evaluated by comparison of the models with experimental data supplod for a cylindrical bed containing iron-titanium (FeTi) alloy. Of these factors, only mass transfer was found to be of negligible importance. An equilibrium model containing no empirical parameters produces bed pressure and temperatures that show good agreement with experimental data; however, events such as maximum pressure and centerline temperatures are predicted at times that differ from those observed. DOE

N81-24554# Midwest Research Inst., Golden, Colo. Building Systems Development Branch.
EFFECTS OF INTERNAL GAIN ASSUMPTIONS IN BUILDING ENERGY CALCULATIONS
Craig Christensen and Robert Perkins (Colorado Univ., Denver) Jan. 1981 8 p refs Presented at the 3rd Ann. Systems Simulation, Econ. Analysis/Solar Heating and Cooling Operational Results Conf., Reno, Nev., 27 Apr. 1981
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/TP-721-1031; CONF-810405-8) Avail: NTIS HC A02/MF A01

The utilization of direct solar gains in buildings can be affected by operating profiles, such as schedules for internal gains, thermostat controls, and ventilation rates. Building energy analysis methods use various assumptions about these profiles. The effects of typical internal gain assumptions in energy calculations are described. Heating and cooling loads from simulations using the DOE 2.1 computer code are compared for various internal gain inputs: typical hourly profiles, constant average profiles, and zero gain profiles. Prototype single-family-detached and multifamily-attached residential units are studied with various levels of insulation and infiltration. Small detached commercial buildings and attached zones in large commercial buildings are studied with various levels of internal gains. The results indicate that calculations of annual heating and cooling loads are sensitive to internal gains, but in most cases are relatively insensitive to hourly variations in internal gains. DOE

N81-24555# Argonne National Lab., Ill.
LOAD RESEARCH MANUAL. VOLUME 2: FUNDAMENTALS OF IMPLEMENTING LOAD RESEARCH PROCEDURES
Nov. 1980 218 p refs 3 Vol.
(Contract W-31-109-eng-38)
(ANL/SPG-13-Vol-2) Avail: NTIS HC A10/MF A01

This manual will assist electric utilities and state regulatory authorities in investigating customer electricity demand as part of cost-of-service studies, rate design, marketing research, system design, load forecasting, rate reform analysis, and load management research. Load research procedures are described in detail. Research programs at three utilities are compared: Carolina Power and Light Company, Long Island Lighting Company, and Southern

California Edison Company. A load research bibliography and glossaries of load research and statistical terms are also included. T.M.

N81-24556# Argonne National Lab., Ill.
LOAD RESEARCH MANUAL. VOLUME 3: LOAD RESEARCH FOR ADVANCED TECHNOLOGIES
Nov. 1980 75 p refs Prepared in cooperation with Gordian Associates, Inc., New York 3 Vol.
(Contract W-31-109-eng-38)
(ANL/SPG-13-Vol-3) Avail: NTIS HC A04/ME A01

Technical guidelines for electric utility load research are presented. Special attention is given to issues raised by the load reporting requirements of the Public Utility Regulatory Policies Act of 1978 and to problems faced by smaller utilities that are initiating load research programs. The manual includes guides to load research literature and glossaries of load research and statistical terms. Special load research procedures are presented for solar, wind, and cogeneration technologies. DOE

N81-24557# Water and Power Resources Service, Denver, Colo.
SOLAR/HYDRO INTEGRATION
Jul. 1980 68 p refs
(Contract DE-AI03-79SF-10505)
(DOE/SF-10505/3) Avail: NTIS HC A04/MF A01

Objectives were: (1) determine the technical and economic viability of integrating solar central receiver with the Federal hydroelectric system in the Lower Colorado Region of the Service; and (2) recommend a prime site and an implementation plan for a feasibility study. Two candidate solar receiver systems are considered. Both are of the Advanced Central Receiver design, each utilizing a central power tower surrounded by a field of two-axis tracking mirrors (heliostats). The principal difference between the two systems is that one uses a molten salt as its heat transfer fluid whereas the other system uses liquid sodium. A description of the Federal hydroelectric power system is given, and a projection of the energy needs for the Lower Colorado service area is presented. Details of the site selection, solar plant evaluation, solar/weather data analysis, energy analysis, integration analysis, economic analysis, environmental analysis, and implementation plan are reported. DOE

N81-24558# Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
APPLICATION OF STATISTICAL TECHNIQUES TO WIND CHARACTERISTICS AT POTENTIAL WIND ENERGY-CONVERSION SITES Final Report, 1 Oct. 1978 - 30 Sep. 1979
Ross B. Corotis May 1980 172 p refs
(Contract DE-AS06-76ET-20283)
(DOE/ET-20283/2) Avail: NTIS HC A08/MF A01

The distribution for the magnitude of the vector sum of two orthogonal horizontal wind velocity components is often modelled by the Rayleigh, which is derived assuming that the components are independent, identically distributed, zero-mean, Gaussian random variables; the probability density function for a more realistic case where the two components are correlated and not equal in variance is derived. It is found that the derived distribution is adequately modelled by the Rayleigh distribution. A 24 hour record of 20 second average wind speed was collected to assess the effect of sampling rate and averaging time on computed wind speed means and variances, autocorrelation, and run duration. Definite effects on autocorrelation and run duration due to averaging time and sampling rate, respectively, are observed. An approximate procedure is developed to simulate the time sequence of wind speed at a single site; the procedure uses a Weibull distribution with conditional parameters updated each hour as a function of the previously simulated value and the autocorrelation. DOE

N81-24559# Solarex Corp., Rockville, Md.
INVESTIGATION OF THE IMPURITY TOLERANCE OF SEMICRYSTALLINE SILICON SOLAR CELLS SILICON IMPACT PROGRAM Final Report, 15 Sep. 1979 - 14 Sep. 1980
G. Storti, W. Regnault, S. Johnson, H. C. Lin, and R. W. Armstrong 1980 197 p refs Prepared in cooperation with Maryland Univ., Baltimore
(Contract DE-AC02-77CH-00178)
(SERI/TR-8272-1-T1) Avail: NTIS HC A09/MF A01

The effects of impurities (for MG silicon material) and the microstructure of the polysilicon material on the electrical characteristics of solar cells fabricated from this material were investigated. Impurity effects were investigated using deep level transient spectroscopy to measure deep trap levels; optical emission spectroscopy and secondary ion mass spectroscopy were used to measure impurity levels. The effects of the crystal microstructure were investigated using electron channelling, angle lapping and straining measurements, X-ray topography, and scanning photoresponse measurements. Both reflection and transmission X-ray topographs of polysilicon material were obtained to reveal a range of microstructural features, including individual dislocations; subgrain boundaries, twin traces, and inclusions. The X-ray topography were matched with optical scanning photoresponse measurements of the same region for which angle lapping results were obtained to show directly the effect of the microstructural features on the photoresponse of individual solar cells. A model is presented of these observations. DOE

N81-24560# National Conference of State Legislatures, Denver, Colo.
SMALL-SCALE HYDROELECTRIC POWER IN THE PACIFIC NORTHWEST: NEW IMPETUS FOR AN OLD ENERGY SOURCE
Jul. 1980 134 p refs Conf. held at Portland, Oreg., 12 Jul. 1979
(Contract DE-FG03-78RA-23220)
(DOE/RA-23220/04; CONF-790799) Avail: NTIS HC A07/MF A01

The small scale hydroelectric power policy projects of the national conference of state legislators (NCSL) was designed to assist state legislators in looking at the benefits of one alternative, small scale hydro. Because of the need for state legislative support in the development of small scale hydroelectric, NCSL, as part of its contract with the Department of Energy, conducted the following conference on small scale hydro in the Pacific Northwest. State obstacles to development and options for change available to policymakers were explored. DOE

N81-24561# National Conference of State Legislatures, Denver, Colo.
SMALL-SCALE HYDROELECTRIC POWER IN THE SOUTHWEST: NEW IMPETUS FOR AN OLD ENERGY SOURCE
Jun. 1980 148 p refs Conf. Presented at Atlanta, 14 Jun. 1979
(Contract DE-FG03-78RA-23220)
(DOE/RA-23220/05; CONF-7906201) Avail: NTIS HC A07/MF A01

A forum was provided for state legislators and other interested persons to discuss the problems facing small scale hydro developers, and to recommend appropriate solutions to resolve those problems. Alternative policy options were recommended for consideration by both state and federal agencies. Emphasis was placed on the legal, institutional, environmental and economic barriers at the state level, as well as the federal delays associated with licensing small scale hydro projects. Legislative resolution of the problems and delays in small scale hydro licensing and development were also stressed. DOE

N81-24562# California Univ., Livermore. Lawrence Livermore Lab.
ESTIMATES OF THE COST AND ENERGY CONSUMPTION OF ALUMINUM-AIR ELECTRIC VEHICLES
J. F. Cooper Nov. 1980 39 p refs Presented at the Fall Meeting of the Electrochem. Soc., Hollywood, Fla., 5-10 Oct. 1980
(Contract W-7405-eng-48)
(UCRL-84445-Rev-1; CONF-8010159-1-Rev-1) Avail: NTIS HC A03/MF A01

Economic costs and primary energy consumption are estimated for general purpose electric vehicles using aluminum-air propulsion batteries within the time frame of the 1990's (earliest possible date of introduction). For an aluminum-air fuel economy of 36 tonne/km/kg-Al (optimized low-gallium alloys), a total refueling cost of 5.6 cents/km (1979$) was estimated

for a 1.27 tonne vehicle. This is equivalent to $2 to 3/gal for automobiles of the same weight with fuel economies of 13.5 to 19.3 tonne-km/liter. The total primary energy consumption was estimated to be 1.3 to 1.7 kWh/km (coal) for the electric vehicle, which corresponds roughly to the energy cost of the automobiles using liquid fuels synthesized from coal. The energy consumption is 30 to 70 percent greater than the reference automobile using petroleum-derived gasoline. DOE

N81-24563# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
GROUND COUPLED SOLAR HEAT PUMPS: ANALYSIS OF FOUR OPTIONS
J. W. Andrews 1981 14 p refs Presented at the 3rd Ann. Systems Simulation, Econ. Anal. Solar Heating and Cooling Operational Results Conf., Reno, Nev., 27 Apr. - 1 May 1981
(Contract DE-AC02-76CH-00016)
(BNL-29007; CONF-810405-12) Avail: NTIS HC A02/MF A01

Heat pump systems which utilize both solar energy and energy withdrawn from the ground are analyzed using a simplied procedure which optimizes the solar storage temperature on a monthly basis. Four ways of introducing collected solar energy to the system are optimized and compared. These include use of actively collected thermal input ot the heat pump; use of collected solar energy to heat the load directly (two different ways); and use of a passive option to reduce the effective heating load. DOE

N81-24564# Battelle Pacific Northwest Labs., Richland, Wash.
COMPARISON OF GEOTHERMAL, SOLAR, AND CONVENTIONAL SPACE HEATING COSTS IN THE UNITED STATES
C. H. Bloomster, B. A. Price, and L. L. Fassbender 1980 5 p refs Presented at the Intern. Symp. Alternative Energy Sources and Technol., Montreal, 28 May 1980
(Contract DE-AC06-76RL-01830)
(PNL-SA-8244; CONF-800567-4) Avail: NTIS HC A02/MF A01

The costs of residential heating throughout the United States using conventional, solar, and geothermal energy were determined under current and projected conditions. Geothermal district heating systems will become economically feasible in most urban centers north of a line extending roughly from Los Angeles to Baltimore. Solar heating systems, with conventional heating backup, will become economically feasible throughout the country. The most economical applications will be in suburban and rural areas in the intermountain West and into the Great Plains region. Conventional heating will remain most economic: (1) in urban centers in the South (where annual heat demand is low0; (2) in Northern urban centers which are too distant from geothermal resources; and (3) in suburban and rural areas with low solar insolation. Conventional energy will supplement solar energy in most locations. DOE

N81-24565# Sandia Labs., Albuquerque, N. Mex. Fluid Mechanics and Heat Transfer Div.
SOLTES: SIMULATOR OF LARGE THERMAL ENERGY SYSTEMS
Merton E. Fewell and Norman R. Grandjean 1981 11 p refs Presented at the 3rd. Ann. Systems Simulation, Econ. Anal. Solar Heating and Cooling Operational Results Conf., Reno, Nev., 27 Apr. 1981
(Contract DE-AC04-76DP-00789)
(SAND-80-1578C; CONF-810405-9) Avail: NTIS HC A02/MF A01

The philosophy, structure, current capability, and applications of SOLTES, a computer code that can be used to simulate a wide variety of thermal energy systems such as solar power/total energy, fossil-fired power plants/total energy, nuclear-fired power plants/tctal energy, solar energy heating and cooling, geothermal energy, and solar hot water, are discussed. The SOLTES program simulates the steady-state response of thermal energy systems to time-varying data such as weather and loads. DOE

N81-24566# Oak Ridge National Lab., Tenn. Energy Div.
SURVEY OF ADVANCED-HEAT-PUMP DEVELOPMENTS FOR SPACE CONDITIONING
Phillip D. Fairchild 1981 15 p refs Presented at the 8th. Energy Technol. Conf. and Exposition, Washington, D.C., 9-11 Mar. 1981
(Contract W-7405-eng-26)
(CONF-810315-6) Avail: NTIS HC A02/MF A01

Some historical notes on heat pump development are discussed. Market and equipment trends, well water and ground-coupled heat pumps, heat-actuated heat pump development, and international interest in heat pumps are also discussed. 30 references. DOE

N81-24567# Solar Business Office, Sacramento, Calif.
COMMERCIALIZING SOLAR FOR INDUSTRY IN CALIFORNIA Final Report
J. Yudelson (Energy Clinic Corp., Concord, Calif.) Oct. 1980 7 p
(Contract DE-FG03-99CS-30284)
(DOE/CS-30284/T1) Avail: NTIS HC A02/MF A01

The State of California has begun a commercialization program for increasing the rate of solar applications in industry. The components of this program include low interest loans, tax credits, revenue bonds and educational efforts. Many California industries appear to be likely candidates for solar systems, but as yet only a few companies have elected to install them. The various barriers to solar use by industry are primarily perceptual and financial. The emphasis of the state program for commercialization is turning increasingly towards educational seminars for industry groups and development of creative financial tools and arrangements. There are a few remaining legislative changes at state and federal levels, primarily involving leasing and tax laws which, if enacted, would overcome all of the remaining financial barriers to widespread adoption of solar applications by industry. DOE

N81-24568# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLAR PHOTOVOLTAIC POWER SYSTEM FOR A RADIO STATION
Burt E. Nichols Dec. 1980 20 p refs
(Contract DE-AC02-76ET-20279)
(COO-4094-85) Avail: NTIS HC A02/MF A01

Of simple construction, the system uses low-cost, prefabricated, transportable units for easy, fast installation and requires minimal site preparation. The first application of this experimental system began operation in August 1979 at daytime AM radio station WNBO in Bryan, Ohio. The project was jointly undertaken by the Laboratory and the radio station. The photovoltaic system described holds promise for a wide range of applications and economic feasibility by the mid to late 1980s. DOE

N81-24569# California Univ., Berkeley. Lawrence Berkeley Lab. Solar Energy Group.
INTERACTION OF A SOLAR SPACE HEATING SYSTEM WITH THE THERMAL BEHAVIOR OF A BUILDING
Christian Vilmer, Mashuri Warren, L., and David Auslander Dec. 1980 13 p refs Presented at the ASME, Solar Energy Div. Conf. on Systems Simulation Econ. Analysis/Solar Heating and Cooling Operational Results, Reno., Nev., 27 Apr. - 1 May 1981
(Contract W-7405-eng-48)
(LBL-11673; CONF-810405-4) Avail: NTIS HC A02/MF A01

The thermal behavior of a building in response to heat input from an active solar space heating system is analyzed to determine the effect of the variable storage tank temperature on the cycling rate, on-time and off-time of a heat cycle and on the comfort characteristics of room air temperature swing and of offset of the average air temperature from the setpoint (droop). A simple model of a residential building, a fan coil heat-delivery system, and a bimetal thermostat are used to describe the system. A computer simulation of the system behavior was developed and verified. The system model and simulation are then applied to determine the building response to a typical hydronic solar heating system for different solar storage temperatures, outdoor temperatures, and fan coil sizes. DOE

N81-24570# Bendix Corp., Kansas City, Mo.
ANALYTICAL MODEL AND PERFORMANCE DATA FOR A CYLINDRICAL PARABOLIC COLLECTOR

F. M. Ford and W. E. Stewart, Jr. (Missouri Univ., Kansas City) 1980 14 p refs Presented at the 3rd Miami Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 15-17 Dec. 1980
(Contract DE-AC04-76DP-00613)
(BDX-613-2559; CONF-801210-17) Avail: NTIS HC A02/MF A01

Concentrating solar collectors provide higher fluid temperatures than flat plate, an important advantage in many applications. The parabolic cylinder is one of the most popular types of concentrating collectors because of its relatively simple construction and tracking configurations. A mathematical model was developed for one such collector in order to predict thermal efficiency as a function of solar insolation. An experiment was then devised in an attempt to verify this model. Discrepancies between predicted and observed values are discussed, and suggestions are made for improving the model and the experimental procedure. DOE

N81-24571# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PERFORMANCE OF A COMBINED PHOTOVOLTAIC/THERMAL, FLAT-PLATE, LIQUID COLLECTOR
W. A. Aiello and P. Raghuraman 1981 8 p refs Presented at the 3rd. Ann. Systems Simulation, Econ. Anal. Solar Heating and Cooling Operational Results Conf., Reno, Nev., 28 Apr. - 1 May 1981
(Contract DE-AC02-76ET-20279)
(DOE/ET-20279/111; CONF-810405-3) Avail: NTIS HC A02/MF A01

A combined photovoltaic/thermal (PV/T), flatplate, liquid collector, where the liquid circulates both below and above the photovoltaic cells (the primary energy-absorbing surface), was designed and tested specifications to yield collector thermal and electrical efficiencies. A one dimensional thermal analysis predicts the test results accurately. On the strength of the test and analytical results, design recommendations are made to maximize the total energy extracted from the collectors. DOE

N81-24572# Los Alamos Scientific Lab., N. Mex. Solar Energy Group.
SOLAR PONDS AS A SOURCE OF LOW TEMPERATURE HEAT
D. A. Neeper and K. A. Meyer 1981 8 p refs Presented at the 8th Energy Technol. Conf. and Exposition, Washington, D.C., 9-11 Mar. 1981
(Contract W-7405-eng-36)
(LA-UR-81-485; CONF-810315-1) Avail: NTIS HC A02/MF A01

Salt-gradient solar ponds are potentially attractive for electric power generation. The progress of salt-gradient solar pond development, both in the United States and abroad is reviewed. Technical problem areas and their implications for commercialization are discussed. Potential market applications for solar ponds are examined. DOE

N81-24573# Midwest Research Inst., Golden, Colo.
SECOND THERMAL STORAGE APPLICATIONS WORKSHOP
Charles E. Wyman and Ronal W. Larson Jun. 1980 87 p Workshop held at San Antonio, 7-8 Feb. 1980
(Contracts EG-77-C-01-4042; DE-AC02-77CH-00178)
(SERI/TP-333-605; CONF-800266) Avail: NTIS HC A05/MF A01

On February 7 and 8, 1980, approximately 20 persons representing the management of both the Solar Thermal Power Systems Program (TPS) of the US Department of Energy (DOE) Division of Central Solar Technology (CST) and the Thermal Energy Storage Program (TES) of the DOE Division of Energy Storage Systems (STOR) met to review the joint Thermal Energy Storage for Solar Thermal Applications (TESSTA) Program and to discuss issues in implementing it. Summaries of the seven major elements of the joint program (six receiver-related, storage development elements, and one advanced technology element are presented. DOE

N81-24574# PFR Engineering Systems, Inc., Marina Del Rey, Calif.
BINARY MODULE TEST Final Report, Dec. 1980
J. R. Schilling, T. C. Colley, and J. Pudyk Dec. 1980 191 p Sponsored by Electric Power Research Inst. Prepared in cooperation with Shilling (J. R.), Woodside, Calif. and Colley Engineers and Constructors, Inc., Gardena, Calif.
(EPRI Proj. 1094)
(EPRI-AP-1645) Avail: NTIS HC A09/MF A01

The design was based on state-of-the-art heat exchanger technology, and the purpose of the tests was to confirm performance of a supercritical boiling cycle using isobutane and a mixture of isobutane and isopentane as the secondary working fluid. Most of the test runs were with isobutane but some data were collected for hydrocarbon mixtures. The results of the field tests are reported. In general these results indicate reasonably good heat balances and agreement with overall heat transfer coefficients calculated by current stream analysis methods and available fluid property data; however, measured pressure drops across the heat exchangers were 20 percent higher than estimated. System operation was stable under all conditions tested. DOE

N81-24575# Los Alamos Scientific Lab., N. Mex.
HEAT PIPES FOR INDUSTRIAL WASTE HEAT RECOVERY
M. A. Merrigan 1981 12 p refs Presented at the 8th Energy Technol. Conf., Washington, D.C., 10 Mar. 1981
(Contract W-7405-eng-36)
(LA-UR-81-560; CONF-810315-5) Avail: NTIS HC A02/MF A01

Development work on the high temperature ceramic recuperator at Los Alamos National Laboratory is described and involved material investigations, fabrication methods development, compatibility tests, heat pipe operation, and the modeling of application conditions based on current industrial usage. Solid ceramic heat pipes, ceramic coated refractory pipes, and high-temperature oxide protected metallic pipes are investigated. Economic studies of the use of heat pipe based recuperators in industrial furnaces are conducted and payback periods determined as a function of material, fabrication, and installation cost. DOE

N81-24576# Atomic Energy of Canada Ltd., Chalk River (Ontario). Nuclear Labs.
THERMAL-HYDRAULIC ANALYSIS OF THE COMBUSTION ENGINEERING SERIES 67 STEAM GENERATOR Final Report
W. W. R. Inch Jan. 1981 172 p refs Sponsored by Electric Power Research Inst.
(EPRI-NP-1678) Avail: NTIS HC A08/MF A01

The results of an analysis using THIRST - a three dimensional, steady state, incompressible, homogeneous, two-phase flow computer code is presented. The analysis was done for operating conditions corresponding to 100%, 50%, and 20% of the nominal full power. The THIRST computer code methodology is discussed, and the assumptions, operating conditions, and empirical correlations are given. Results are presented in the form of detailed printouts and computer-generated plots of quality, velocity and mass flux distributions. The printout data include calculated values of overall heat transfer, circulation ratio, primary inlet temperature, as well as velocity, quality, temperature, pressure and density fields. DOE

N81-24577# CH2M/Hill, Bellevue, Wash.
ENGINEERING EVALUATION OF MAGMA COOLING-TOWER DEMONSTRATION AT NEVADA POWER COMPANY'S SUNRISE STATION Final Report
Nov. 1980 201 p refs Prepared for Electric Power Research Inst.
(EPRI Proj. 1260-10)
(EPRI-CS-1626) Avail: NTIS HC A10/MF A01

The Magma Cooling Tower (MCT) process utilizes a falling film heat exchanger integrated into an induced draft cooling tower to evaporate waste water. A hot water source such as return cooling water provides the energy for evaporation. Water quality control is maintained by removing potential scaling constituents to make concentrations of the waste water possible without scaling heat transfer surfaces. A pilot-scale demonstration test of the MCT process was performed from March 1979 through June 1979 at Nevada Power Company's Sunrise Station in Las Vegas, Nevada. The pilot unit extracted heat from the powerplant cooling system to evaporate cooling tower blowdown. Two water

quality control methods were employed: makeup/sidestream softening and fluidized bed crystallization. The 11 week softening mode test was successful. DOE

N81-24578# Combustion Engineering, Inc., Windsor, Conn. C-E Power Systems Dept.
EVALUATION AND DEMONSTRATION OF METHODS FOR IMPROVED FUEL UTILIZATION Semiannual Progress Report, Sep. 1979 - Mar. 1980
U. Decher 25 Jun. 1980 44 p refs Prepared in cooperation with Omaha Public Power District, Nebr.
(Contract DE-AC02-79ET-34010)
(COO-34010-1; CEND-382; SAPR-1) Avail: NTIS HC A03/MF A01

Two techniques for improving fuel utilization in current Pressurized Water Reactors are demonstrated: more efficient fuel management and high burnup. More efficient fuel management will be achieved through the implementations of a low leakage concept called SAVFUEL (Shimmed and Very Flexible Uranium Element Loading), which is expected to reduce uranium requirements by 2 to 4%. The burnup will be increased sufficiently to reduce uranium requirements by 5 to 15%. DOE

N81-24579# Radian Corp., Austin, Tex.
GEOTHERMAL ANALYTICAL REPORT
1980 9 p
(Contract DE-AC02-79ET-27026)
(DOE/ET-27026/T6; DCN-80-212-003-X) Avail: NTIS HC A02/MF A01

Two samples were precracked by fatigue and exposed to separated geothermal brines in a closed autoclave. Final load and crack length were measured and a fractographic examination performed on compact double catilever beam samples. The fractographs are shown. DOE

N81-24580# Gilbert/Commonwealth, Reading, Pa.
PRELIMINARY ANALYSIS OF 500 MWt MHD POWER PLANT WITH OXYGEN ENRICHMENT Final Report
Apr. 1980 59 p refs
(Contracts DE-AC01-77ET-11058; ET-78-C-01-2688)
(GAI-2075-A) Avail: NTIS HC A04/MF A01

An MHD Engineering Test Facility design concept is analyzed. A 500 MWt oxygen enriched MHD topping cycle integrated for combined cycle operation with a 400 MWe steam plant is evaluated. The MHD cycle uses Montana Rosebud coal and air enriched to 35 mole percent oxygen preheated to 1100 F. The steam plant is a 2535 psia/1000 F/1000 F reheat recycle that was scaled down from the Gilbert/Commonwealth Reference Fossil Plant design series. Integration is accomplished by blending the steam generated in the MHD heat recovery system with steam generated by the partial firing of the steam plant boiler to provide the total flow requirement of the turbine. The major MHD and steam plant auxiliaries are driven by steam turbines. When the MHD cycle is taken out of service, the steam plant is capable of stand-alone operation at turbine design throttle flow. This operation requires the full firing of the steam plant boiler. A preliminary feasibility assessment is given, and results on the system thermodynamics, construction scheduling, and capital costs are presented. DOE

N81-24581# Hittman Associates, Inc., Columbia, Md.
MAJOR MODELS AND DATA SOURCES FOR RESIDENTIAL AND COMMERCIAL SECTOR ENERGY CONSERVATION ANALYSIS Final Report
Sep. 1980 175 p refs
(Contract DE-AC01-79PE-70044)
(DOE/PE-70044/T2; H-C1011/002-80-931F) Avail: NTIS HC A08/MF A01

Major models and data sources are reviewed that can be used for energy-conservation analysis in the residential and commercial sectors to provide an introduction to the information that can or is available to DOE in order to further its efforts in analyzing and quantifying their policy and program requirements. Purpose; basic for model structure; policy variables and parameters; level of regional, sectoral, and fuels details; output; input requirements; sources of data; computer accessibility and requirements. A bibliography is provided for each model and data source. DOE

N81-24582# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.
MHD GENERATOR ELECTRODE DEVELOPMENT Quarterly Report, Oct. - Dec. 1980
John W. Sadler, Laurence H. Cadoff, Don L. Dietrick, James A. Dilmore, Edsel W. Frantti, Dave Jacobs, Edgar L. Kochka, Jack A. Kuszyk, S. K. Lau, and Joseph Lampert Jan. 1981 91 p refs
(Contract DE-AC01-79ET-15529)
(DOE/ET-15529/9) Avail: NTIS HC A05/MF A01

This program is directed towards the engineering development of cold metallic electrodes which are alternatives to the use of platinum as an anode clad material for MHD generators. Results of continuing laboratory screening tests are presented. Improvements in the anode arc test methodology and test setup, which resulted in improved reproducibility as well as test simplification, are discussed. Laboratory electrochemical corrosion testing was initiated using aqueous and molten salts as the aggressive constituent in the electrolyte. Initial results from these tests are reported. On the basis of these test results, electrochemical corrosion tests using a molten salt are preferred. DOE

N81-24583# Battelle Pacific Northwest Labs., Richland, Wash.
INVESTIGATIONS ON CATALYZED STEAM GASIFICATION OF BIOMASS
L. K. Mudge, S. L. Weber, D. H. Mitchell, L. J. Sealock, Jr., and R. J. Robertus Jan. 1981 162 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3695) Avail: NTIS HC A08/MF A01

The technical and economic feasibility of producing specific gas products via the catalytic gasification of biomass are evaluated. Results of research conducted from December 1977 to October 1980 are presented. Laboratory studies were conducted to develop operating conditions and catalyst systems for generating methane-rich gas, synthesis gases, hydrogen, and carbon monoxide; these studies also developed techniques for catalyst recovery, regeneration, and recycling. A process development unit was designed and constructed to evaluate laboratory systems at conditions approximating commercial operations. The economic analyses evaluated the feasibility of adapting the wood-to-methane and wood-to-methanol processes to full-scale commercial operations. Plants were designed in the economic analyses to produce fuel-grade methanol from wood and substitute natural gas from wood via catalytic gasification with steam. DOE

N81-24584# Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
HANDBOOK FOR THE APPLICATION OF STATISTICAL TECHNIQUES TO WIND CHARACTERISTICS AT POTENTIAL WIND-ENERGY-CONVERSION SITES Final Report, 1 Oct. 1978 - 30 Sep. 1979
Ross B. Corotis May 1980 29 p refs
(Contract DE-AS06-76ET-20283)
(DOE/ET-20283/3) Avail: NTIS HC A03/MF A01

Effective utilization of data in determining the wind regime is important in gaining the most reliable information necessary to assess turbine performance and generated power in a relatively short period of on-site collection. This handbook specifically discusses adjustment procedures and reliability measures for the mean wind speed at a site; selection of a probability distribution for the hourly wind speed and calibration from observed data; employment of a probability model for wind speed persistence; speed at a site and array power from a region. A brief discussion of the limitations implicit in National Weather Service data is also included. DOE

N81-24585*# IBM Federal Systems Div., Huntsville, Ala.
SOLAR ENERGY SYSTEM ECONOMIC EVALUATION: CONTEMPORARY NEWMAN, GEORGIA Final Report
Sep. 1980 102 p refs
(Contract NAS8-32036)
(NASA-CR-161727) Avail: NTIS HC A06/MF A01 CSCL 10A

An economic evaluation of performance of the solar energy system (based on life cycle costs versus energy savings) for five cities considered to be representative of a broad range of environmental and economic conditions in the United States is discussed. The considered life cycle costs are: hardware,

installation, maintenance, and operating costs for the solar unique components of the total system. The total system takes into consideration long term average environmental conditions, loads, fuel costs, and other economic factors applicable in each of five cities. Selection criteria are based on availability of long term weather data, heating degree days, cold water supply temperature, solar insolation, utility rates, market potential, and type of solar system. E.A.K.

N81-24586# Elektowaerme-Inst. Essen e.V. (West Germany).
POSSIBILITIES OF ENERGY RECOVERY AND INTEGRATED ENERGY SUPPLY FOR FOUNDRIES Final Report
Juergen Pautz Bonn Bundesministerium fuer Forschung und Technologie Aug. 1980 46 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-042; ISSN-0340-7608) Avail: NTIS HC A03/MF A01

The energy utilization of foundries equipped with electric melting and arc furnaces was investigated. Systems were studied which optimize heat economy. Studies of the energy balance of arc furnaces with conventional refractory linings and with water cooled linings clearly demonstrate recovery possibilities as a function of the temperature of the waste heat. Domestic water heating, central heating, scrap drying and steam generator plant applications are proposed for the recovered heat. A considerable overall improvement in efficiency can be achieved. Author (ESA)

N81-24587# Wack (Oskar K.) Chemie G.m.b.H., Ingolstadt (West Germany).
CLEANING SYSTEM FOR SOLAR ENERGY COLLECTORS Final Report
Oskar K. Wack Bonn Bundesministerium fuer Forschung und Technologie Aug. 1980 30 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-045; ISSN-0340-7608) Avail: NTIS HC A03/MF A01

Reduction of light transmission caused by soiling of solar energy collectors was measured under laboratory conditions. The magnitude of possible energy losses was determined. Glass slides (30 X 55mm) were soiled with three different test dirts. The energy losses vary between 9% and 20%, depending on soil load (0.4 to 0.9 g/sq m) and soil type. Given the significance of these results, their verification by testing glass surfaces soiled under outdoor conditions is proposed. The development of a prototype automatic cleaning system for solar energy collectors is also suggested. A literature search shows no reference to research on the soiling problem of solar energy collectors. Author (ESA)

N81-24588# Cube Ingenieurunion G.m.b.H., Worms (West Germany).
DEVELOPMENT OF AN OPTIMIZING METHOD FOR THE DESIGN OF A BURIED PIPELINE SYSTEM TO BE USED AS A HEAT SOURCE FOR HEAT PUMPS Final Report
Hans Ludwig vonCube, Edgar Ludwig, Johann Sattlegger (Ingenieurbuero Sattlegger), and Juergen Rohde (Ingenieurbuero Sattlegger) Bonn Bundesministerium fuer Forschung und Technologie Aug. 1980 317 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie Original contains color illustrations
(BMFT-FB-T-80-121; ISSN-0340-7608) Avail: NTIS HC A14/MF A01

A calculation method suitable for EDP calculation with difference steps for space and time, which allows the representation of isothermic lines and the calculation of heat flow to and from the ground as well as freezing processes by the solution of a two dimensional linear operator (Crank-Nicolson method), was developed. The physical characteristics of the ground were assessed, including heat transmission into the air and to deeper surface layers. Theoretical and mathematical methods of calculating ground temperature fields were then reviewed. Design criteria are determined, concerning the pipe laying method, the dimensioning of the pipe, and the predicted density of heat flow. Author (ESA)

N81-24589# Fraunhofer-Inst. fuer Bauphysik, Stuttgart (West Germany).
HEAT ENERGY CONSUMPTION AND INTERMITTENT HEATING Final Report
Norbert Koenig and Christian Kupke Bonn Bundesministerium fuer Forschung und Technologie Aug. 1980 55 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-072; ISSN-0340-7608) Avail: NTIS HC A04/MF A01

A quantitative assessment of the possible reduction in space heating energy consumption when using an intermittent heating mode as compared to a continuous heating mode is offered. In situ measurement methods used in rooms with different heat storage capacity and different heating systems or heating appliances are described. A calculation program to demonstrate the effect of system parameter variation on energy consumption is presented. A comparison of experiment with calculations indicates that in an ordinary residence an energy savings of 10 to 35% can be achieved by employing an intermittent heating mode, depending on the type of wall construction and the number of hours various rooms are in use. Moreover, for the heating of offices and factories, the use of electronic control systems can lead to savings of 50% in heat energy consumption. Author (ESA)

N81-24590# Fachhochschule, Esslingen (West Germany). Labor fuer Lueftungs- und Klimatechnik.
A SOLAR ENERGY SYSTEM AS A COMPLEMENT TO A CONVENTIONAL HEATING SYSTEM: MEASUREMENT OF THE STORAGE AND CONSUMPTION OF SOLAR ENERGY Final Report
Ernst Doering and Willi Lippe Bonn Bundesministerium fuer Forschung und Technologie Sep. 1980 51 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-079; ISSN-0340-7608) Avail: NTIS HC A04/MF A01

A residential house, having a fuel oil based heating system (radiators and floor heating; domestic hot water), was equipped with a solar energy conversion plant which supplemented the water heating system. Total insolation, the energy received by the solar collectors, and energy consumption for heating and domestic hot water were monitored. Results show the collector system to have a conversion efficiency of 15.4%. The solar energy system contribution to overall energy consumption was 6.1%. Improvement of the solar energy plant is discussed. Suggestions include enlarging the collector surface, atteration of the regulation scheme, utilization of thermal stratification in the conception of solar heat storage, better insulation of conduit pipes, and avoidance of shadowing the collectors. Author (ESA)

N81-24591# Ruhrkohle A.G., Essen (West Germany).
COAL PROCESSING PLANTS Final Report
Walter Bitterlich, Thomas Bohn, H.-Guenter Eickhoff, Horst Geldmacher, Wolfgang Mengis, Hassan Oomatia, and K.-Guenter Stroppel Bonn Bundesministerium fuer Forschung und Technologie Aug. 1980 149 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie Prepared in cooperation with Essen Univ., West Germany and Kernforschungsanlage Juelich GmbH, West Germany Original contains color illustrations
(BMFT-FB-T-80-097; ISSN-0340-7608) Avail: NTIS HC A07/MF A01

The efficient design of processing plants which combine various coal based technologies in order to maximize the effectiveness of coal utilization is considered. The technical, economical and ecological virtues which compound plants for coal conversion offer are assayed. Twenty-two typical processes of coal conversion and product refinement are selected and described by a standardized method of characterization. An analysis of product market and a qualitative assessment of plant design support six different compound plant propositions. The incorporation of such coal conversion schemes into future energy supply systems was simulated by model calculations. The analysis shows that byproducts and nonconverted materials from individual processes can be processed in a compound plant in a profitable manner. This leads to an improvement in efficiencies.

The product spectrum can be adapted to a certain degree to demand variations. Furthermore, the integration of fluidized bed combustion can provide an efficient method of desulfurization. Compound plants are expected to become economic in the 1990's. A necessary condition to compound technologies is high reliability in the functioning of all individual processes. Author (ESA)

N81-24592# Man-Turbomotoren G.m.b.H., Munich (West Germany). Neue Technologie.

DEVELOPMENT OF AN ECONOMIC SOLAR HEATING SYSTEM WITH COST EFFICIENT FLAT PLATE COLLECTORS Final Report

Waldburg Eder-Milchgeisser and Roland Burkart Bonn Bundesministerium fuer Forschung und Technologie Oct. 1980 24 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-80-113; ISSN-0340-7608) Avail: NTIS HC A02/MF A01

Mass produced flat plate solar collectors were worked into the design of a system for heating a swimming pool and/or providing domestic hot water. The collector characteristics, including physical and mechanical data as well as theoretical energy conversion efficiency, are presented. The collector was tested and service life efficiency was determined. The mounting of the collector, depending on roof type, is explained. Both in service and laboratory test results demonstrate the cost effectiveness of the system. Further improvement of efficiency is envisaged with automatic flow control in the solar collector and hot water circuits. Author (ESA)

N81-24593# Staatliches Forschungsinstitut fuer Geochemie, Bamberg (West Germany).

INVESTIGATION OF THE INFLUENCE OF ADDITIVES ON THE STORAGE OF HYDROGEN IN ALLOYS. COMPOUNDING WITH INTERMETALLICS [UNTERSUCHUNGEN UEBER DEN EINFLUSS VON ZUSAETZEN AUF DIE SPEICHERUNG VON WASSER-STOFF IN LEGIERUNGEN BZW. INTERMETALLISCHEN VERBINDUNGEN]

H. Meier Bonn Bundesministerium der Verteidigung 1980 103 p refs In GERMAN; ENGLISH summary

(BMVG-FBWT-80-10) Avail: NTIS HC A06/MF A01

The reversible storage of hydrogen in metals and alloys is described, and the possibility of improving hydrogen storage sytems with additives is discussed. Thermodynamic and kinetic data (hydrogen storage capacity, dissociation enthalpy, 1 bar decomposition temperature, absorption and desorption rates, activation energy) are given for FeTi alloys and Mg alloy systems. It is shown that in FeTi alloys the highest hydrogen weight content can be obtained by alloying 2 to 4 mass % cerium. Moreover, hysteresis in pressure composition isotherms can be diminished, replacing Fe in FeTi containing misch metal by Zr or Mn. In Mg/Ni alloys with low nickel content an enhancement of the atom ratio H/M (up to 1.7, corresponding to G sub H = 6.2 % H2) is possible by the addition of small amounts of other elements. Kinetic experiments show that binary and ternary Mg alloy systems are characterized by rapid dehydriding rates (1 to 2 hr at 300 C) and rapid hydriding kinetics, i.e., a negative temperature dependence (2 to 4 min at 245 C). Author (ESA)

N81-24594# Department of Housing and Urban Development, Washington, D. C.

RESIDENTIAL ENERGY EFFICIENCY STANDARDS STUDY Final Report, Report to Congress

Jul. 1980 144 p

(Contract HUD-H-5040)

(PB81-169831; HUD-PDR-614; HUD-0001733) Avail: NTIS HC A07/MF A01 CSCL 05K

Six major issue areas address the concerns raised in the legislation, including the feasibility of developing an energy efficiency standard for existing units, the amount of energy that would be saved by the implementation of a mandatory standard over and above the energy savings estimated as resulting from current programs, and the impact of such a standard on individual households. Other concerns are how the implementation would affect credit availability and related financial matters, how it would affect the building community, and what major administrative options are available to implement the Section 253 requirement. GRA

N81-24595# Hoffman-Muntner Corp., Silver Spring, Md.

ENVIRONMENTAL, OPERATIONAL, AND ECONOMIC ASPECTS OF THIRTEEN SELECTED ENERGY TECHNOLOGIES

Lawrence Hoffman, Stephen E. Noren, and Elmer C. Holt, Jr. Sep. 1980 243 p refs

(Contract EPA-68-01-4999)

(PB81-153926; EPA-600/7-80-173) Avail: NTIS HC A11/MF A01 CSCL 10A

The environmental operational and economic aspects of thirteen current and developing technologies are examined as applied to the generation of electric power, steam generation, and the conversion of fossil energy into alternative forms. The following technologies are addressed: (1) Conventional Boiler; (2) Diesel Engine; (3) Fluidized Bed Combustion; (4) Combined Cycle Systems; (5) Low/Medium Btu Gasification; (6) Chemically Active Fluid Bed; (7) Indirect Coal Liquefaction; (8) High Btu Gasification; (9) Surface Shale Oil Processing; (10) In situ Shale Oil Processing; (11) Direct Coal Liquefaction; (12) Fuel Cells; and (13) Magnetohydrodynamics. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N81-24596 Yale Univ., New Haven, Conn.

AN EMPIRICAL AIR QUALITY ANALYSIS UTILIZING COMPUTER-ASSISTED CARTOGRAPHIC MODELING TECHNIQUES Ph.D. Thesis

Ian Harrington vonLindern 1980 357 p

Avail: Univ. Microfilms Order No. 8109823

A method is proposed for analyzing air quality problems as spatial relationships through the use of computer-assisted cartographic modeling techniques. Geographically oriented data are stored, manipulated, and analyzed in the form of computer maps. An empirical air pollutant dispersion model is developed as a spatial relationship in an intrinsically linear form. The cartographic analysis system is interfaced with a statistical data management package and the model is parameterized by a multiple regression optimization technique. The methodology is applied to the analyses of heavy metal particulates surrounding a lead/zinc smelter. Industrial point sources and fugitive emissions are considered. Nonhomogeneity associated with complex terrain and inconstant source behavior is addressed. The effect of re-entrained fugitive dusts on the attainment of the National Ambient Air Quality Standard for Lead is quantified and presented graphically. Dissert. Abstr.

N81-24597 Illinois Univ. at Urbana-Champaign.

QUANTITATIVE APPORTIONMENT OF URBAN AEROSOL MASS BY FACTOR ANALYSIS Ph.D. Thesis

Daniel Jeremy Alpert 1980 157 p

Avail: Univ. Microfilms Order No. 8108436

A receptor method for quantitatively resolving the sources of airborne particulate matter was developed. This procedure, called target transformation factor analysis (TTFA), requires no prior knowledge about the nature of the system under study. TTFA can determine the number sources that are contributing to the system, determine the elemental composition of the particles emitted by each source, and estimate the amount of material that each source contributed to each sample. TTFA was applied to a set of simulated aerosol samples to evaluate its utility for resolving the sources of airborne particles. An analysis of a small set of aerosol samples collected in Boston, MA, demonstrated the resolution of sources in real samples. Finally, TTFA was applied to a subset of the aerosol-composition data acquired during the Regional Air Pollution Study (RAPS) of St. Louis, MO. The RAPS program collected nearly 34,000 samples with ten, continuously operated, dichotomous samplers from March 1975 through March 1977. Dissert. Abstr.

N81-24598 Stanford Univ., Calif.

NUMERICAL MANAGEMENT MODELS OF GROUNDWATER POLLUTION Ph.D. Thesis

Steven Marc Gorelick 1981 154 p

Avail: Univ. Microfilms Order No. 8108935

Quantitative descriptions of the functioning of groundwater-solute systems are incorporated into management models. This combined use of simulation and management methods is shown to be valuable in managing aquifers that are used for both waste disposal and water supply. The models employ numerical simulation techniques, linear programming, and linear superposition to inspect problems of hydraulic management as well as groundwater pollution management. A series of hypothetical groundwater pollution problems are used to develop and demonstrate the management methods. The technique used for both two dimensional steady state hydraulic and groundwater pollution management models is to incorporate finite difference approximations of the governing partial differential equations as constraints in linear programs. The hydraulic management model is applied to an illustrative problem involving contaminant plume containment in the context of regional groundwater management. The pollution management model is applied to the problem of optimizing safe waste disposal potential. Dissert. Abstr.

N81-24599 Florida State Univ., Tallahassee.
CHARACTERIZATION OF THE STRUCTURE OF MARINE AND ESTUARINE BENTHIC AND FOULING MICROBIAL COMMUNITIES USING LIPID CHEMISTRY Ph.D. Thesis
Ronald John Bobbie 1980 170 p
Avail: Univ. Microfilms Order No. 8104258

Assays for microbe derived lipid components, emphasizing fatty acids, capable of providing an accurate analysis of the structure of estuarine microbial communities are modified and developed. The lipid components were identified by capillary gas chromatography mass spectrometry and the lipid analysis was shown to correspond to scanning electron microscope morphology. Multiple analysis employing a variety of other biochemical markers proved to be essential in overcoming environmental variability and providing validation of the structure of complex benthic microbial communities as determined by lipid chemistry. Lipid analysis provided evidence for the relative effectiveness of two physical antifouling procedures and characterized differences in the marine biofouling community structure on aluminum and titanium pipes. Actual field studies verified the applicability of lipid analyses in trophodynamic studies. Lipid analyses were proven a valuable approach in delineating microbial community structure, and were proven capable of assaying shifts in composition undetectable by conventional means. Dissert. Abstr.

N81-24600 Washington Univ., Seattle.
A TIME DEPENDENT MODEL OF SEDIMENT TRANSPORT AND STRATA FORMATION ON A CONTINENTAL SHELF Ph.D. Thesis
Nancy Brandeberry Kachel 1980 131 p
Avail: Univ. Microfilms Order No. 8109740

A model is presented of the erosion, transport, and deposition of sediment on a continental shelf similar to that off southern Washington. The features of the continental shelf environment that are considered important in sediment transport calculations are: the passage of large storms that leave their mark in the geologic record, the density stratification that suppresses the upward diffusion of mass and momentum; and the poorly sorted sediments that characterize mid-shelf deposits. A physical oceanographic model was utilized to characterize the interior flow and the boundary layer dynamics during a large storm. It is concluded that the sediments with diameters smaller than .088 mm will form a transient, highly mobile population on a continental shelf. Dissert. Abstr.

N81-24601*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ANALYTIC MODEL FOR WASHOUT OF HCl(G) FROM DISPERSING ROCKET EXHAUST CLOUDS
G. L. Pellett May 1981 92 p refs
(NASA-TP-1801; L-14107) Avail: NTIS HC A05/MF A01 CSCL 13B

The potential is investigated that precipitation scavenging of HCl from large solid rocket exhaust clouds may result in unacceptably acidic rain in the Cape Canaveral, Florida, area before atmospheric dispersion reduces HCl concentrations to safe limits. Several analytic expressions for HCl(g) and HCl(g + aq) washout are derived; a geometric mean washout coefficient is recommended. A previous HCl washout model is refined and applied to a space shuttle case (70 t HCl exhausted up to 4 km) and eight Titan 3 (60 percent less exhaust) dispersion cases. The vertical column density (sigma) decays were deduced by application of a multilayer Gaussian diffusion model to seven standard meteorological regimes for overland advection. The Titan 3 decays of sigma and initial rain pH differed greatly among regimes; e.g., a range of > 2 pH units was spanned at $x > 100$ km downwind and $t = > 2$ hr. Environmentally significant pH's $< .5$ for infrequent exposures were shown possible at $X = < 50$ km and $t < 5$ hr for the two least dispersive Titan 3 cases. Representative examples of downwind rainwater pH and G(X) are analyzed. Factors affecting the validity of the results are discussed. A.R.H.

N81-24602*# Virginia Polytechnic Inst. and State Univ., Blacksburg.
CONTINUED RESEARCH ON SELECTED PARAMETERS TO MINIMIZE COMMUNITY ANNOYANCE FROM AIRPLANE NOISE Second Year Report, Apr. 1980 - Mar. 1981
Les Frair Mar. 1981 79 p refs
(Grant NsG-1958)
(NASA-CR-164299) Avail: NTIS HC A05/MF A01 CSCL 13B

Results from continued research on selected parameters to minimize community annoyance from airport noise are reported. First, a review of the initial work on this problem is presented. Then the research focus is expanded by considering multiobjective optimization approaches for this problem. A multiobjective optimization algorithm review from the open literature is presented. This is followed by the multiobjective mathematical formulation for the problem of interest. A discussion of the appropriate solution algorithm for the multiobjective formulation is conducted. Alternate formulations and associated solution algorithms are discussed and evaluated for this airport noise problem. Selected solution algorithms that have been implemented are then used to produce computational results for example airports. These computations involved finding the optimal operating scenario for a moderate size airport and a series of sensitivity analyses for a smaller example airport. Author

N81-24603*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
THE SULFUR BUDGET OF THE TROPOSPHERE Progress Report, 1 Dec. 1979 - 30 Nov. 1980
S. N. Tiwari and T. R. Augustsson Feb. 1981 56 p refs
(Contract NCC1-30)
(NASA-CR-164371) Avail: NTIS HC A04/MF A01 CSCL 13B

A one dimensional photochemical tropospheric model was used to calculate the vertical profiles of tropospheric species. Particular attention is focused on the recent inclusion of the chemistry of the sulfur group, which consists of 13 species involving a total of 45 chemical reactions. It is found that the chemistry of the sulfur species, because it is largely anthropogenic, plays an increasingly important role in the distribution of tropospheric gases. The calculated vertical profiles were compared to available measurements and generally found to be in good agreement. T.M.

N81-24604# Epsilon Labs., Bedford, Mass.
STRATOSPHERIC AEROSOL MEASUREMENTS Final Report, 10 Jul. 1979 - 30 Oct. 1980
Henry A. Miranda, Jr. Dec. 1980 25 p refs
(Contract F19628-79-C-0130; AF Proj. 6687)
(AD-A097716; AFGL-TR-80-0366) Avail: NTIS HC A02/MF A01 CSCL 04/1

The Epsilon/AFGL balloon-borne aerosol sizing spectrometer was flown on a stratospheric balloon flight on 27 May 1980 over Holloman AFB, N.M., in an attempt to correlate with the SAGE four-channel solar limb extinction experiment. Useful aerosol altitude concentration profiles were obtained within several hundred Km and several hours of the SAGE overpass subtangent point. The data indicate that particles greater than 0.4 micron diameter are absent above the tropopause (14 Km in this instance). Speculations regarding a possible explanation for this effect are offered. Predictions of SAGE tangential extinction vs. altitude from aerosols alone have been derived from the data, and are

included to facilitate correlation and comparison with those derived from aerosol models currently in vogue. Author (GRA)

N81-24605# Oak Ridge Gaseous Diffusion Plant, Tenn. Systems and Equipment Technology Dept.

COOLING TOWER DRIFT STUDY; DRIFT MEASUREMENT AND ANALYSIS OF THE MEASURING TECHNIQUE

S. H. Park Jan. 1981 19 p refs Presented at the Ann. Cooling Tower Inst. Tech. Meeting, Houston, Tex., 19 Jan. 1981

(Contract W-7405-eng-26)

(K/ET-5020; CONF-810123-1) Avail: NTIS HC A02/MF A01

The results from two tests, which were performed on the same counterflow mechanical draft cooling tower, indicated an order of magnitude difference in the measured drift fractions. To ascertain the reason for the wide divergence in results, the measuring techniques used in the two tests were compared. The analysis showed that the sensitive paper method is most reliable and its superiority is primarily due to a large sampling area than that associated with the optical measuring device. DOE

N81-24606# General Electric Co., St. Petersburg, Fla. Corporate Research and Development Dept.

HIGH PERFORMANCE CYCLONE DEVELOPMENT

W. B. Giles 1981 14 p refs Presented at the 3rd. Symp. on the Transfer and Util. of Particulate Control Technol., Orlando, Fla., 9-12 Mar. 1981

(Contract DE-AC01-80ET-17091)

(CONF-810319-1) Avail: NTIS HC A02/MF A01

The results of cold flow experiments at atmospheric conditions of an air shielded 18 in dia electrocyclone with a central cusped electrode are reported using fine test dusts of both flyash and nickel powder. These results are found to confirm expectations of enhanced performance, similar to earlier work on a 12 in dia model. An analysis of the combined inertial-electrostatic force field is also presented which identifies general design goals and scaling laws. From this it is found that electrostatic enhancement will be particularly beneficial for fine dusts in large cyclones. Recommendations for further improvement in cyclone collection efficiency are proposed. DOE

N81-24607# Los Alamos Scientific Lab., N. Mex.

SUMMARY OF THE SETTING, AIR QUALITY PROBLEMS, AND METEOROLOGICAL ACTIVITIES IN THE OIL SHALE REGION

Summer Barr and William E. Clements 1981 8 p refs Presented at the Ascot Modeling Meeting, Tucson, Ariz., 5-6 Feb. 1981

(Contract W-7405-eng-36)

(LA-UR-81-533; CONF-810218-2) Avail: NTIS HC A02/MF A01

Air quality problems in the valleys of the Uinta mountains and the Roan Ridge in the oil shale area in western Colorado and eastern Utah are discussed. A meteorological field expedition that was undertaken in August 1980 by LASL and PNL is described. DOE

N81-24608# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.

RELATIVE IMPORTANCE OF ATMOSPHERIC SULFATES AND NITRATES IN VISIBILITY REDUCTION

I. N. Tang, W. T. Wong, and H. R. Munkelwitz 1980 11 p refs Presented at the Symp. on Plumes and Visibility, Grand Canyon, Ariz., 10-14 Nov. 1980

(Contract DE-AC02-76CH-00016)

(BNL-28346; CONF-801114-9) Avail: NTIS HC A02/MF A01

In an effort to ascertain the relative role that atmospheric sulfates and nitrates play in visibility reduction, total scattering coefficients are calculated for mixed-salt aerosols composed of various proportions of sulfates and nitrates under different humidity conditions. The thermodynamic and optical data required in the droplet growth and Mie calculations were measured in laboratory experiments for the specific multicomponent systems of interest. Results are compared with published empirical correlations to provide a physical basis for the observed variability of visibility data with chemical composition of the ambient aerosol. DOE

N81-24609# Oak Ridge Y-12 Plant, Tenn. Product Certification Div.

DETERMINATION OF PLUTONIUM IN AIR AND SMEAR SAMPLES

E. R. Hinton, Jr. and W. O. Tucker 27 Feb. 1981 18 p refs (Contract W-7405-eng-26)

(Y-2237) Avail: NTIS HC A02/MF A01

A method was developed for the determination of plutonium in air samples and smear samples that were collected on filter papers. The sample papers are digested in nitric acid, extracted into 2-thenoyltrifluoroacetone (TTA)-xylene, and evaporated onto stainless steel disks. Alpha spectrometry is employed to determine the activity of each plutonium isotone. Each sample is spiked with plutonium-236. All glassware used in the procedure is disposable. The detection limits are 3 and 5 dpm (disintegrations per minute) for air and smear samples, respectively, with an average recovery of 87 percent. DOE

N81-24610# Battelle Pacific Northwest Labs., Richland, Wash.

MOUNT SAINT HELENS RELATED AEROSAL PROPERTIES FROM SOLAR EXTINCTION MEASUREMENTS

J. J. Michalsky, E. W. Kleckner, and G. M. Stokes Nov. 1980 10 p refs Presented to Inst. for Atmospheric Optics and Remote Sensing Symp. and Workshop, Washington, D.C., 18 Nov. 1980

(Contract DE-AC06-76RL-01830)

(PNL-SA-8901; CONF-801160-3) Avail: NTIS HC A02/MF A01

The optical extinction due to the introduction of aerosols and aerosol precursors into the troposphere and stratosphere during the major eruptive phase of Mount St. Helens, Washington, is quantified. The concentration is on the two week period centered on the major eruption of 22 July 1980. DOE

N81-24611# Battelle Pacific Northwest Labs., Richland, Wash.

USE OF ION CHROMATOGRAPHY FOR ANALYSIS OF MAP3S PRECIPITATION SAMPLES

Jane Rothert Jul. 1980 5 p refs Presented at 22d Rocky Mountain Conf., Denver, 11-14 Aug. 1980

(Contract DE-AC06-76RL-01830)

(PNL-SA-8425; CONF-800837-2) Avail: NTIS HC A02/MF A01

The Multistate Atmospheric Power Production Pollution Study/Regional Acidity of Industrial Emissions. MAP3S/RAINE program includes measurement and modeling of fossil-fuel effluent concentrations in precipitation and air in the northeastern United States. To determine precipitation concentrations of sulfur and nitrogen oxides pH, and conductivity, an eight 1 site precipitation network in rural eastern United States was established. Two Dionex Model 10 ion chromatographs were used to analyze the precipitation samples. DOE

N81-24612# National Oceanic and Atmospheric Administration, Oak Ridge, Tenn. Atmospheric Turbulence and Diffusion Lab.

ENVIRONMENTAL RESEARCH LABORATORIES Annual Report, 1979 - 1980

Mar. 1981 67 p

(ATDL-81/4) Avail: NTIS HC A04/MF A01

The program is organized around the following subject areas: transport and diffusion over complex terrain, atmospheric turbulence and plume diffusion, and forest meteorology and climatological studies. Current research efforts involve experimental and numerical modeling studies of flow over rugged terrain, studies of transport of airborne material in and above a forest canopy, basic studies of atmospheric diffusion parameters for applications to basic studies of atmospheric diffusion parameters for applications to environmental impact evaluation, plume rise studies, and scientific collaboration with personnel in DOE funded installations, universities, and government agencies on meteorological studies in our area of expertise. DOE

N81-24613# Emory Univ., Atlanta, Ga. Dept. of Biology.

ECOLOGICAL BEHAVIOR AND EFFECTS OF ENERGY-RELATED POLLUTANTS Progress Report, 1 Nov. 1979 - 31 Jan. 1981

Harvey L. Ragsdale and William H. Murdy Jan. 1981 58 p refs

(Contract DE-AS05-76EV-02412)

(DOE/EV-02412/105) Avail: NTIS HC A04/MF A01

Research progress is reported for the period November 1979 through January 1981 in the following areas: definition of the stages of plant sexual reproduction most susceptible to SO2 stress; the role of flower structure and function on the susceptibility of sexual reproduction to SO2 stress; and the effect of the SO2-NO2 combination on plant sexual reproduction. DOE

N81-24614# IEA Coal Research, London (England).
NITROGEN OXIDES FROM COAL COMBUSTION: ENVIRONMENTAL EFFECTS
Irene Smith Oct. 1980 98 p refs
(ICTIS/TR-10; ISBN-92-9029-055-2) Avail: NTIS HC A05/MF A01

Recent literature on the environment effects of nitrogen oxides is reviewed, and the role of coal combustion relative to other sources is ascertained. The natural occurence and most important reactions of nitrogen oxides in the atmosphere and biosphere are outlined. Natural and anthropogenic emissions are related to the potential global problems of ozone depletion and the greenhouse effect. The analysis of emissions from various sources in different regions reveals that oil combustion (particularly from transportation in urban areas) contributes to a greater proportion of the emissions than coal in many cases. The major part of emissions due to coal conbustion is from power plants and nitrogen oxide emissions from this source are therefore considered in more detail, including measurements of ground level concentrations relative to those from mobile sources. The environmental effects on health, plants, ecological systems and materials are studied separately. Evidence is often inconsistent and unrealistic for the purposes of assessing the effects of nitrogen oxides from coal combustion. It is difficult to isolate these effects from those of other pollutants. Air pollution legislation, including standards, guidelines or objectives in different countries are then compared. Monitoring of nitrous oxide in the atmosphere along with maximum concentrations of nitric oxide and nitrogen dioxide in regions of high emissions is recommended. More date are required to assess the effects of nitrogen oxides on human health. Author (ESA)

N81-24615# IEA Coal Research, London (England).
NITROGEN OXIDES FROM COAL COMBUSTION: ABATEMENT AND CONTROL
Geoffrey F. Morrison Nov. 1980 87 p refs
(ICTIS/TR-11; ISBN-92-9029-058-7) Avail: NTIS HC A05/MF A01

The recent literature relating to the abatement and control of nitrogen oxides from coal fired utility boilers is reviewed. The formation and decomposition of nitrogen oxides during coal combustion are assessed, and operational factors, such as air preheat, excess air, furnace size and load, burner design, burner interaction with firing pattern, and coal composition, which influence the concentration of nitrogen oxides in the flue gas are discussed. Typical nitrogen oxide emissions from coal fired utility boilers currently in operation are included. Abatement extends to combustion modifications, such as burner design, two stage combustion, low excess air firing, flue gas recirculation and furnace design. Control covers post combustion flue gas treatment. The dry nitrogen oxide removal processes discussed include selective catalytic reduction processes, selective noncatalytic reduction processes, nonselective catalytic reduction processes, adsorption processes and a radiation process. Wet nitrogen oxide removal processes are subclassified as oxidation-absorption reduction processes, absorption-reduction processes, absorption-oxidation processes and oxidation-absorption processes. Conclusions show combustion modifications can reduce nitrogen oxide emissions from new coal fired utility boilers to less than 200 ppm by the mid 1980's. If even lower emissions are required by law, as is increasingly likely in some countries, the more expensive option of nitrogen oxide is required. Author (ESA)

N81-24616# Radian Corp., Austin, Tex.
STUDY OF AIR POLLUTION CONTROL TECHNOLOGY: CASE STUDIES OF AIR POLLUTION CONTROL TECHNOLOGY INNOVATIONS Final Report
R. L. Leonard, A. S. Forrest, E. D. Gibson, T. A. Hall, M. L. Personett, L. L. Zimmerman, and S. R. Fernandes 13 Nov. 1980 352 p
(Contract NCAQ-156-AQ-7421)
(PB81-152563; RAD-80-203-003-05; AQ-7421-158) Avail: NTIS HC A16/MF A01 CSCL 13D

The results of 67 personal interviews with individuals who were involved in the development of one or more of eight control technologies are presented. The technologies studied are: wet limestone flue gas desulfurization (FGD); dry FGD; atmospheric fluidized bed combustion; NOx control for utilities; Stage 2 hydrocarbon vapor recovery; three way catalysts; SOx control for copper smelters and inherently low-polluting pushing processes for coke ovens. GRA

N81-24617# Boyle Engineering Corp., Orlando, Fla.
TERTIARY TREATMENT OF WASTEWATER USING FLOW THROUGH WETLAND SYSTEMS Status Report
Walter R. Fritz and Steven C. Helle Mar. 1980 115 p ref
(Grant NSF PFR-78-19199)
(PB81-148033; Q-NO4-101-50; NSF/RA-800044; SR-2) Avail: NTIS HC A06/MF A01 CSCL 06F

To identify and quantify design parameters for implementing such systems, a study was conducted and the development of the monitoring system and its preliminary mapping are described. A brief history of the project, the study approach, the research plan, preliminary results and recommendations for monitoring future periods are presented. Research on a water budget study development of a water budget model, instructions for a water monitoring program and output from a water budget program are included. GRA

N81-24618# General Accounting Office, Washington, D. C. Community and Economic Development Div.
INDOOR AIR POLLUTION: AN EMERGING HEALTH PROBLEM
24 Sep. 1980 46 p refs
(PB81-160087; CED-80-111) Avail: NTIS HC A03/MF A01 CSCL 06F

Various harmful pollutants including radon, formaldehyde, and nitrogen dioxide were found in the air in homes, offices, schools, and even in recreational facilities. The problem may event be made worse by Government energy conservation programs which encourage the 'buttoning-up' of buildings. Until responsibility is assigned to one agency to oversee federal efforts, they will continue to be ineffectual. GRA

N81-24619# Bureau of Mines, Salt Lake City, Utah. Salt Lake City Research Center.
ANALYTICAL CHEMISTRY OF THE CITRATE PROCESS FOR FLUE GAS DESULFURIZATION, INFORMATION CIRCULAR, 1980
W. N. Marchant, S. L. May, W. W. Simpson, J. K. Winter, and H. R. Beard 1980 27 p refs
(PB81-148207; BM-RI-8819; LC-79-607974) Avail: NTIS HC A03/MF A01 CSCL 07D

The citrate process for flue gas desulfurization (FGD) is a product of continuing research to meet the goal of minimizing the objectionable effects of minerals industry operations upon the environment. The reduction of SO2 in solution by H2S to produce elemental sulfur by the citrate process is extremely complex and results in solutions that contain at least nine different sulfur species. Process solution analysis is essential to a clear understanding of process chemistry and its safe, efficient operation. The various chemical species, the approximate ranges of their concentrations in citrate process solutions, and the analytical methods evolved to determine them are discussed. GRA

N81-24620# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
BENZENE EMISSIONS FROM BENZENE STORAGE TANKS: BACKGROUND INFORMATION FOR PROPOSED STANDARDS
Dec. 1980 277 p refs
(Contract EPA-68-02-3063)
(PB81-151433; EPA-450/3-80-034A) Avail: NTIS HC A13/MF A01 CSCL 13B

These standards would apply to all new and existing storage tanks having a capacity of 4 cubic meters or larger, which are to be used for the storage of pure benzene. Existing sources will have to comply with the standard within 90 days of its

effective date, unless a waiver of compliance is secured from the Administrator. Background information and environmental and economic impact assessments of the regulatory alternatives considered in developing the proposed standards are provided. GRA

N81-24621# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
BENZENE FUGITIVE EMISSIONS: BACKGROUND INFORMATION FOR PROPOSED STANDARDS
Nov. 1980 292 p refs
(PB81-151664; EPA-450/3-80-032A) Avail: NTIS HC A13/MF A01 CSCL 13B

Background information for the proposed standard is provided. Control technologies and five regulatory alternatives are evaluated in terms of environmental and economic impacts on both new and existing emission sources. Included in the evaluation of environmental impacts are estimates of air quality, water, noise, and solid waste impacts. Included in the evaluation of economic impacts are estimates of total capital and annualized costs, including recovery credits. GRA

N81-24622# Radian Corp., Austin, Tex.
INTERAGENCY FLUE GAS DESULFURIZATION EVALUATION Final Report, May - Dec. 1977
J. C. Dickerman, D. H. Brown, and W. R. Menzie Feb. 1981 488 p refs
(Contract EPA-68-02-2608)
(PB81-152043; RAD-80-202-187-16-31; EPA-600/7-81-015; EPA-600-13) Avail: NTIS HC A21/MF A01 CSCL 13B

Results of a 6 month study of the gas desulfurization (FGD) technology conducted by an interagency team in 1977 are given. The study was mandated by President Carter in his April 1977 National Energy Plan. The purpose of the study was to determine whether additional Federal funding would accelerate the commercialization and acceptance of FGD technology. It is concluded that FGD is the most viable short-term approach to meeting increased coal-use objectives of the National Energy Plan, and specific EGD research, development, and demonstration priorities are identified. GRA

N81-24623# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
VOC FUGITIVE EMISSIONS IN SYNTHETIC ORGANIC CHEMICALS MANUFACTURING INDUSTRY: BACKGROUND INFORMATION FOR PROPOSED STANDARDS
Nov. 1980 245 p refs
(Contract EPA-68-02-3058)
(PB81-152167; EPA-450/3-80-033A) Avail: NTIS, HC A11/MF A01 CSCL 13B

Standards of performance to control fugitive emissions of VOC are proposed under Section III of the Clean Air Act. Information on SOCMI, emission control technology for fugitive emissions of VOC, Regulatory Alternatives which were considered, analyses of environmental, energy, costs, and other technical data to support the standard of performance are presented. GRA

N81-24624# Science Applications, Inc., East Brunswick, N.J.
FIELD TESTING TO DETERMINE THE PRESENCE OR ABSENCE OF SULFUR DIOXIDE EMISSIONS FROM OLD IN SITU OIL SHALE FIELD SITES
Dec. 1980 28 p refs Sponsored by DOE
(PB81-154320; EPA-600/7-80-182) Avail: NTIS HC A03/MF A01 CSCL 13B

One of the major technology needs in the development of the oil shale industry is to adopt and develop methods for controlling the release of pollutants to the environment. Large quantities of sulfur dioxide may be generated from oil shale retorting operations. Sulfur dioxide is a pollutant when released to the atmosphere and must be controlled when concentrations exceed legal standards. This project was a brief field testing effort to determine if sulfur dioxide emissions were being released from old (in situ) oil shale sites. GRA

N81-24625# Tennessee Valley Authority, Chattanooga. Office of Natural Resources.
TRANSPORT AND TRANSFORMATION OF SULFUR OXIDES THROUGH THE TENNESSEE VALLEY REGION
Timothy L. Crawford and Lawrence M. Reisinger Jun. 1980 152 p refs
(PB81-147340; EPA-600/7-80-126) Avail: NTIS HC A08/MF A01 CSCL 13B

The long-range atmospheric transport and transformation of sulfur compounds are investigated. Statistical and climatological analyses of historical data and the results of two long-range transport studies are presented. The atmospheric transport field studies were conducted over a 300 sq km area centered on the Tennessee Valley region containing seven large coal-fired power plants and one large city. The predominant flow and mass transport direction is from the southwest to the northeast. Aerometric measurements obtained by aircraft and ground sampling compared favorably with results obtained with an analytical transport-transformation model developed. During prevailing southwesterly airflow, large sulfur influexes are present. These influxes, which are at the same order of magnitude as the Tennessee Valley regional emission fluxes, can only partly be explained by upwind anthropogenic sources. Natural source emission are hypothesized to account for about half of this sulfur. GRA

N81-24626# Mississippi State Univ., Mississippi State. Dept. of Microbiology.
FATE AND EFFECT OF OIL IN THE AQUATIC ENVIRONMENT, GULF COAST REGION Final Report
Lewis R. Brown Jul. 1980 306 p refs
(Contract EPA-68-01-0745)
(PB81-151045; EPA-600/3-80-058B) Avail: NTIS HC A14/MF A01 CSCL 06F

Both laboratory and field sized pilot-plant ecosystem studies are reported. Emphasis was placed on the long-term, low level chronic effects of oil pollution on the ecosystem. Of the five crudes employed in the investigation, Empire Mix crude was studied most intensively. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N81-24627 Washington Univ., Seattle.
STRUCTURE, PETROLOGY AND EMPLACEMENT OF THE OPHIOLITIC INGALLS COMPLEX, NORTH-CENTRAL CASCADES, WASHINGTON
Robert Bruce Miller 1980 476 p
Avail: Univ. Microfilms Order No. 8109754

The late Jurassic Ingals complex S and W of the Mt. Stuart Batholith contains ultramatic tectonites whose petrology and structure are described. Mantle-type structures predate the two major fault zones which dominate the structure of the complex. A second fault-bounded supracrustal sequence consists of finer-grained and more siliceous sediments with minor limestones; it has been penetratively deformed. The two fault zones are characterized by tectonic blocks in a steeply dipping sheared serpentinite matrix. The overall structure is that of a tectonic melange. Metagabbros and metadiabases in the southern zone show complicated primary relationships. In the roof pendant of the late Cretaceous Mt. Stuart Batholith, the Windy Pass Thrust separates ultramafites equivalent to the Ingalls from the structurally lower pelitic Chiwaukum Schist of the Skagit Crystalline Core of the N. Cascades. Thrusting is considered to be northward and probably of large magnitude. Dissert. Abstr.

N81-24628 Utah Univ., Salt Lake City.
TOPOGRAPHIC PROFILE ANALYSIS OF PIEDMONT SCARPS, NORTHERN WASATCH FRONT, UTAH Ph.D. Thesis
James Frederick Petersen 1981 138 p
Avail: Univ. Microfilms Order No. 8111303

Evidence of age based on characteristics of slope form and the relationships between fault scarps and geomorphic features of Lake Bonneville is used to gain an understanding of how the

profile form of piedmont scarps changes over time. Topographic profile analysis of fault scarps and the wave-cut cliffs of Lake Bonneville have provided a degree of age control that can be used to document the changes in the form of a piedmont scarp over time. Several variables of slope form were measured and found to be age dependent. These form attributes are poorly correlated immediately after offset, and become increasingly interadjusted as erosion modifies the scarp. The morphology of piedmont scarps can be explained by a shift in the focus of erosional stresses to the portion of the scarp profile that is most out of adjustment with the rest of the slope system. General groupings of scarps of approximately equivalent age are noted. Dissert. Abstr.

N81-24629 Stanford Univ., Calif.
GEOLOGY OF A CRETACEOUS SUBDUCTION COMPLEX, WESTERN CHICHAGOF ISLAND, SOUTHEASTERN ALASKA Ph.D. Thesis
John Evans Decker, Jr. 1981 199 p
Avail: Univ. Microfilms Order No. 8108911

The geology of the Chugach terrane on Chichagof and Baranof Islands in southeastern Alaska is described and mapped in detail. The Goon Dip Greenstone and the Whitestripe Marble are pre-Late Jurassic in age and possibly correlate with Triassic rocks in the Wrangell Mountains. The Kelp Bay Group is a chaotic metasedimentary and metavolcanic terrane correlative with Lower Cretaceous complexes in the Chugach Mountains and adjacent islands. The Ford Arm Formation consists mainly of flyschoid rocks continuous with Upper Cretaceous rocks of the Valdez Group in the Chugach Mountains and correlative with the Kodiak and Shumagin Formations in southwest Alaska. The Sitka Graywacke consists mainly of massive sandstone petrographically similar to the Ford Arm Formation. The occurrence, geochemistry, and petrology of metavolcanic rocks from Chichagof Island indicate that basaltic ocean floor volcanism was contemporaneous with deposition of continental sediment. Dissert. Abstr.

N81-24630 Stanford Univ., Calif.
THE ACCOMMODATION OF RELATIVE MOTION ALONG THE SAN ANDREAS FAULT SYSTEM IN CALIFORNIA Ph.D. Thesis
William Herbert Prescott 1981 199 p
Avail: Univ. Microfilms Order No. 8108980

The mode of accommodation of relative motion along the plate boundary beneath the seismogenic zone is investigated. Observations strongly imply that below the seismogenic zone relative motion is distributed over a zone and occurs by inelastic flow rather than by aseismic slip on discrete fault planes. The rate of dilatation and the rate and direction of shear were determined from trilateration data for 23 Geodolite networks in the Western United States. Of the nets located away from the San Andreas fault only Ogden and Hebgen show significant strain accumulation. The direction of shear agrees very well with the surface strike of nearby faults, even in regions like the big bend. Analysis of a network of 115 lines crossing the San Andreas, Hayward and Calaveras faults in the vicinity of San Francisco Bay indicates that the deformation is not uniformly distributed across the area. Dissert. Abstr.

N81-24631 Rensselaer Polytechnic Inst., Troy, N. Y.
THE SEDIMENTOLOGY OF THE DEAD SEA Ph.D. Thesis
Raymond Alan Garber 1980 223 p
Avail: Univ. Microfilms Order No. 8109311

The study of the mineralogy and grain size of sediments of the Dead Sea reveals that of the primary minerals, gypsum concentrates in the coarse silt and sand fraction whereas aragonite falls in the clay and fine silt fractions. The predominant sediment is clayey silt. The constituents of which the bottom sediments are composed fall into two groups: particles of detrital or recycled rocks (limestone, quartz and clay particles); and crystals of minerals precipitated in place (aragonite, gypsum and halite). Aragonite concentrations are low in bottom sediments of the northern Dead Sea and increase southwards. Gypsum occurs in bottom sediments from all water depths. The rate of sulfate reduction does not keep pace with the rate of sulfate precipitiation. Halite was found in the southern part of the northern basin. Dissert. Abstr.

N81-24632 Colorado State Univ., Fort Collins.
STEEPLAND CHANNEL RESPONSE TO EPISODIC EROSION Ph.D. Thesis
Michael David Harvey 1980 283 p
Avail: Univ. Microfilms Order No. 8110809

An experimental study of steepland channel response to episodic erosion was performed in a large flume. A study in the Little South Fork of the Cache la Poudre River, Larimer County, Colorado, was carried out during the 1979 snowmelt runoff season in order to investigate, under field conditions, phenomena observed in the flume study. Steepland drainage basins can be divided into three zones (1,2,3), on the basis of sediment supply, availability of energy, and the presence or absence of confining valley walls. Zone 1 channels are sites of sediment introduction and temporary storage of coarse sediment, which is eventually mobilized and transported downstream to Zone 2. Zone 2 channels are essentially conduits for sediment transported from Zone 1. Large in-channel fans are formed at channel confluences. The development of a single incised channel on the fans indicates that the sediment stored in Zone 2 is exhausted as does the development of headcuts in the channel themselves. The morphology of Zone 3 channels is dependent on the type and quantity of sediment delivered to them from Zone 1 via Zone 2 channels. Dissert. Abstr.

N81-24633 Florida State Univ., Tallahassee.
THE SUBTROPICAL JET STREAM OF WINTER SIMULATION AND SENSITIVITY STUDIES Ph.D. Thesis
Hashmi Hadi Abughalya 1981 165 p
Avail: Univ. Microfilms Order No. 8109928

A multi-level quasi-geostrophic model was designed to study the tropics and middle latitude general circulation for the Northern Hemisphere winter. A coarse mesh (5 degrees x 5 degrees) domain covering global belt from 30 degrees S to 70 degrees N with three beta-planes was used. A time-independent heating, used in this study is composed of latent heating in low latitudes and a heating derived from the mean winter motion field for middle and high latitudes. The effect of planetary scale smoothed topography was included as a lower boundary. Simulation with real data initial state showed agreement with mean flow field in terms of planetary scale features. Other sensitivity experiments were carried out with zonal flow for the initial state. The separate effects of topography and differential heating on global and regional scales were assessed. Dissert. Abstr.

N81-24634 Case Western Reserve Univ., Cleveland, Ohio.
AN INVESTIGATION OF TEMPERATURE AND METALLIC COMPOSITION OF THE LOWER IONOSPHERE Ph.D. Thesis
Craig Allen Tepley 1981 299 p
Avail: Univ. Microfilms Order No. 8109613

The results of complementary optical and radar observations of the lower ionosphere are presented. Metallic composition and the distribution of individual species are determined through spectrophotometric techniques using the resonant scattering of sunlight in twilight. At the same time, the vertical structure of the ionosphere, exhibited through the electron density, is monitored. Metal ions are found to be arranged in layers where these layers are formed in and behave according to the tropical tidal wind system. Typical layer compositions are found to agree with meteoric debris ratios for the metals and with other experimental methods such as rocket borne mass spectrometers. A metallic chemical model is developed to compare with experimental measurements. The model includes the dynamical effects of an equatorial-tropical circulation cell on the metals. Other metallic distributions at higher latitudes are suggested. The temperature of the mesosphere is also found using both radar and optical techniques. Dissert. Abstr.

N81-24635 Illinois Univ. at Urbana-Champaign.
SINKHOLE FORM AS AN INDICATOR OF PROCESS IN KARST LANDSCAPE EVOLUTION Ph.D. Thesis
Ardith Kay Hansel 1980 175 p
Avail: Univ. Microfilms Order No. 8108531

Sinkhole cross sections were surveyed in the field using breaks in slope as sample points. A multiquadratic equation was fitted to these sample data to interpolate height values between points and derive slope and curvature distributions for each

sinkhole cross section. Five diagnostic elements (morphometric parameters) were extracted from each profile curve, namely the means of the slope distributions of the two wall segments and the means of the curvature distributions of the two wall segments plus the base segment. In this manner the cross sectional shapes of thirty-one sinkholes from the normal fluviokarst and thirty one sinkholes from the exhuming fluviokarst were characterized. A conceptual model of the interaction between rates of subterranean sediment removal and alluvial sediment delivery was used to detail hypothetical cross sectional forms. Dissert. Abstr.

N81-24636 Illinois Univ. at Urbana-Champaign.
PALEOGEOMORPHOLOGY AFFECTING EARLY PENNSYLVANIAN FLORAS IN ROCK ISLAND COUNTY, ILLINOIS Ph.D. Thesis
Richard Lee Leary 1980 153 p
Avail: Univ. Microfilms Order No. 8108575

Plant fossils preserved in basal Pennsylvanian rocks of western Illinois are significant because composition of many of the paleonfloras differs from those of more commonly preserved and better studied coal swamp floras. Floras dominated by Megalopteris and Lesleya and containing Noeggerathiales and Cordaites grew on well drained uplands. Subsurface data and exposure of the pre-Pennsylvanian unconformity in Rock Island County, Illinois, reveal a surface of low relief with scattered steep sided valleys as much as 60 m deep and hills up to 20 m high. A karst topography developed on Devonian limestone in the Rock Island County area. Basal Pennsylvanian strata in the Rock Island County area provide evidence for several cycles of erosion and deposition. Paleoland forms, smooth bedrock surfaces, and lack of limestone debris at the pre-Pennsylvanian unconformity (post Late Devonian - preWestphalian B) surface indicate a warm, humid climate in earliest Pennsylvanian. Dissert. Abstr.

N81-24637 Texas Univ. at Arlington.
AN EARLY CRETACEOUS FOSSIL FLORA FROM NORTHWEST TEXAS: ITS COMPOSITION AND IMPLICATIONS Ph.D. Thesis
Bruce Steven Serlin 1980 206 p
Avail: Univ. Microfilms Order No. 8109238

A small but significant flora has been located Albian, Lower Cretaceous strata, in northwest Texas. The plants are entrapped in the chert nodules for which the Edwards is known. Crystallographic studies of the chert nodules are described. The flora consists of a fern, a possible seed fern, several conifers and two fragmentary angiosperm remains. The fern material has proven to be distal fragments of Weichselia. One of the conifers resembles the extant genus Dacrydium. A second conifer is Sequoia. Present and past distribution patterns of related extant plants are reviewed. The relationship of this flora with other Lower Cretaceous floras has been examined. This flora contains plants which are not found in either the older Glen Rose flora or the younger Woodbine flora, it appears to have little common with the floras known from the east coast. Dissert. Abstr.

N81-24638 Minnesota Univ., Minneapolis.
DISPARATE ANODE-CATHODE CORONAL LIGHT EMISSION Ph.D. Thesis
Charles Arthur Marttila 1980 204 p
Avail: Univ. Microfilms Order No. 8109467

A large 1.2 m diameter electrostatic generator operating near 250 kV in room air was used to produce positive and negative coronas simultaneously from the ends of special metal electrodes suspended at the center of a .4 m gap between the generator and a ground plane. A portion of the coronal light emission .001 m wide could be focused by a collecting lens onto a photomultiplier tube. Corona currents could be monitored across a small non-inductive resistor. A multi-channel analyzer was variously used to produce pulse-height spectra of either the coronal light discharges or of the corona currents. The light emissions were scanned in steps across the entire discharge region. Dissert. Abstr.

N81-24639 Texas Univ. at Arlington.
STUDIES IN AEROSOL PHYSICS AND ATMOSPHERIC ELECTRICITY Ph.D. Thesis
Richard J. Tropp 1979 133 p
Avail: Univ. Microfilms Order No. 8109269

A method (electronic cascade impaction) of measuring the particle size distribution of aerosols is presented and an instrument called an electronic cascade impactor (ECI) which uses the method is described. Aerosol particles are charged in a unipolar charger and enter a multistage cascade impactor. Each collection stage and the final filter is isolated electrically from other parts of the impactor and connected to an electrometer detector. Particles deposit on the collection stages according to their aerodynamic diameters, and from the associated electrical current the deposition rate onto each stage and the particle size distribution can be determined. Calibration data for the ECI are presented. The ECI was used to monitor ambient atmospheric aerosols and to look for short term correlations with atmospheric electrical parameters. Dissert. Abstr.

N81-24640 Texas Univ. at Arlington.
FOR NUMERICAL SIMULATION OF AXIALLY SYMMETRIC GRAVITATIONAL COLLAPSE Ph.D. Thesis
Pieter Greer Dykema 1980 250 p
Avail: Univ. Microfilms Order No. 8109156

The evolution of vacuum, asymptotically flat, axially symmetric, irrotational initial data for the field equations of the General Theory of Relativity was followed by means of numerical simulation. The initial hypersurfaces were constructed to represent either an instant of time symmetry or an instant of time antisymmetry in the manifold. An instance was found of a spacetime in which there is a trapped surface in the future development of a time symmetric slice which does not not itself contain such a surface. The evolutions were maximally constrained. The Hamiltonian constraint was solved for the conformal factor of the spatial metric. The momentum constraints were used to obtain combinations of extrinsic curvature components which vanish identically in the case of spherical symmetry. Dissert. Abstr.

N81-24641 Missouri Univ. -Columbia.
GENETIC STRATIGRAPHY OF THE MISSISSIPPI SYSTEM IN CENTRAL MISSOURI Ph.D. Thesis
David Thompson King, Jr. 1980 129 p
Avail: Univ. Microfilms Order No. 8108815

Stratigraphic units of the Mississippian System in Central Missouri (in ascending order: Bachelor Sandstone, Chouteau Group, Burlington Limestone, and Keokuk Limestone) accumulated during an uninterrupted marine transgression in Kinderhookian and Osagean time are discussed. Resedimented material accumulated adjacent to buildup complexes. The carbonate buildup complex trends perpendicularly to the shelf edge, which is influenced by the configuration of the Brown's Station anticline. The internal details and structural control of the carbonate buildup complexes are similar to the 'Waulsortian facies' described from both Europe and North America. Principal differences are the larger scale and the cement-encrusted inner cores of the Waulsortian facies. The crinoid-flanked buildups (Burlington and Keokuk Limestones) were deposited below effective wave base which is suggested by: (1) the general absence of shallow water structures and fossils; (2) the absence of algae and micritized grains; (3) the lack of grain abrasion; (4) the vertical trend to buildups; (5) the presence of graded bedding; (6) the similarity to other deep water facies; and (7) the depositional setting on the Burlington shelf. Dissert. Abstr.

N81-24642 State Univ. of New York at Binghamton.
GEOLOGY OF THE WESTERN SIERRA DE SANTA CRUZ, GUATEMALA, CENTRAL AMERICA: AN OPHIOLITE SEQUENCE Ph.D. Thesis
Joshua Henry Rosenfeld 1981 330 p
Avail: Univ. Microfilms Order No. 8109638

Mapping of the western end of the massif revealed that the base of the allochthon consists of a serpentinite matrix melange and a highly deformed argillite. The latter is metamorphosed in the prehnite pumpellyite facies and is interpreted to be a pelagic sedimentary unit overridden by the ophiolite during obduction. The ophiolite is composed of a basal tectonized and serpentinized harzburgite enclosing a gabbroic pluton at least two kilometers thick with associated ultramafic cumulates and quartz diorites. The pluton is capped by a zone of diabase which intrudes and feeds massive and pillowed basalt flows with intercalated

pelagic chert and limestone. The intrabasalt sedimentary rocks were dated as Valaginian to Lower Cenomanian. The basalts are overlain by a sequence of tuffaceous cherts which coarsen upward to volcaniclastic flysch and epiclastic volcanic breccia containing andesitic and dacitic lava and welded tuff fragments. Dissert. Abstr.

N81-24643 State Univ. of New York at Binghamton.
STRATIGRAPHY, DEPOSITIONAL ENVIRONMENTS, AND CARBONATE PETROLOGY OF THE TOROWEAP AND KAIBAB FORMATIONS (LOWER PERMIAN), GRAND CANYON REGION, ARIZONA Ph.D. Thesis
Roger Alan Clark 1981 454 p refs
Avail: Univ. Microfilms Order No. 8110508

Sediments deposited in northwestern Arizona during Late Leonardian and Early Guadalupian (Permian) were controlled chiefly by an arid climate and the tectonic setting. Eastward thrusting of eugeosynclinal rocks onto miogeosynclinal deposits during Middle Devonian to Early Mississippian had a major influence on shelf sedimentation. The Toroweap and Kaibab formations represent two such platform sequences of northwestern Arizona and southern Utah deposited during this phase of sedimentation. The Toroweap Formation is subdivided into three members and represents sediments deposited during initial transgression, maximum extent of the sea, and regression (Seligman, Brady Canyon, and Woods Ranch members respectively). The Fossil Mountain Member of the Kaibab Formation documents the most extensive phase of sedimentation for all members of the Toroweap and Kaibab formations. The Harrisburg Member documents the final phase of sedimentation at the close of the Paleozoic Era. Dissert. Abstr.

N81-24644 State Univ. of New York at Albany.
THE IMPACT OF SELECTED ATMOSPHERIC PARAMETERS ON SOLAR RADIATION Ph.D. Thesis
Lonzy James Lewis 1980 164 p
Avail: Univ. Microfilms Order No. 8109383

A radiative transfer calculation was applied to several model atmospheres to obtain solar fluxes at the Earth's surface. An modified version of the classical method of successive order of scattering was used to solve the equation of transfer. The intensity function, source function, and phase function were all approximated by truncated series. Multiple scattering effects were accounted for in the calculation. Scattering by both aerosols and cloud and included. Mie theory was used to obtain single scattering parameters for the suspended particulates and cloud droplets. All particles were treated as homogeneous spheres. Model simulations were compared with experimental measurements for six case studies. Prediction and observation of the total available energy agreed to within 10 percent on clear days and on days with little cloudiness. The predictability of the model decreases with increasing cloudiness. Prediction of the diffuse flux is unsatisfactory. Dissert. Abstr.

N81-24645 Deutscher Wetterdienst, Offenbach am Main (West Germany).
THE ROLE OF RADIATIVE PROCESSES IN A MODEL FOR BOUNDARY LAYER INVERSIONS [DIE ROLLE VON STRAHLUNGSPROZESSEN IN EINEM MODELL FUER ABGEHOBENE INVERSION]
E. Schaller 1980 68 p refs In GERMAN; ENGLISH summary
(ISBN-3-88148-180-X; ISSN-0072-4130) Avail: Issuing Activity

Inversions capping the planetary boundary layer, found over different climatic regions of the globe depending on seasonal variations in the general circulation, are modeled mathematically. The inversion height as well as the structure of the boundary layer depends on the magnitude of large-scale subsidence, turbulent mixing in the boundary layer itself, and on the radiative net flux divergence. A simple model is presented which allows for all three processes to be studied internally in dependence of the atmospheric profiles above the inversion and the surface values of temperature and humidity. The radiative net flux divergence is parameterized on the basis of the delta two stream solution of the radiative transfer equation. The sensitivity of the boundary layer on the radiative processes is investigated; large scale subsidence and turbulent mixing are kept constant in order to demonstrate the radiation influence. Typical profiles of net radiation and radiative net flux divergence in an inversion-capped planetary boundary layer with a stratus or stratocumulus cloud deck just below the inversion are presented. The radiative heating rate shows two distinct minima at the top of the inversion and in the upper part of the cloud deck and two maxima near the inversion base and near the cloud base. Author (ESA)

N81-24646 Deutscher Wetterdienst, Offenbach am Main (West Germany).
INVESTIGATION OF THE ENERGY BUDGET COMPONENT IN THE ATMOSPHERIC BOUNDARY LAYER ABOVE A PINE FOREST IN THE UPPER RHINE VALLEY (HARTHEIM) [UNTERSUCHUNGEN UEBER DIE ENERGIEHAUSHALT-SKOMPONENTEN IN DER ATMOSPHAERISCHEN GRENZ-SCHICHT AM BEISPIEL EINES KIEFERNBESTANDES IN DER OBERRHEINEBENE (HARTHEIM/RH.)]
Ruediger Schott 1980 61 p refs In GERMAN; ENGLISH summary
(ISBN-3-88148-182-6; ISSN-0072-4130) Avail: Issuing Activity

The gathering of micrometeorological data at a control point in the Hartheim pine forest, and the subsequent data analysis, are described. A difference measuring method and a profile measuring technique are compared. Heat and water balance were determined (Aug. 1974 to Jul. 1975). Heat flux at the ground and for the pine canopy were evaluated. Wind profile parameters were also investigated based on wind velocity measurements. Results show that the indirectly determined evapotranspiration rate above the young pine forest correlates well with measured radiation intensity and that the latent heat flux corresponds to 62.8% of radiant energy. Author (ESA)

N81-24647*# California Univ. at Los Angeles. Dept. of Physics.
EFFECTS OF TURBULENCE ON A KINETIC AURORAL ARC MODEL
J. M. Cornwall and Y. T. Chiu (Aerospace Corp., El Segundo, Calif.) May 1981 47 p refs
(Contracts NASw-3434; NASw-3327; Grant NSF ATM-78-19958)
(NASA-CR-164353; SSL-81(7951)-2) Avail: NTIS HC A03/MF A01 CSCL 04A

A plasma kinetic model of an inverted-V auroral arc structure which includes the effects of electrostatic turbulence is proposed. In the absence of turbulence, a parallel potential drop is supported by magnetic mirror forces and charge quasi neutrality, with energetic auroral ions penetrating to low altitudes; relative to the electrons, the ions' pitch angle distribution is skewed toward smaller pitch angles. The electrons energized by the potential drop form a current which excites electrostatic turbulence. In equilibrium the plasma is marginally stable. The conventional anomalous resistivity contribution to the potential drop is very small. Anomalous resistivity processes are far too dissipative to be powered by auroral particles. It is concluded that under certain circumstances equilibrium may be impossible and relaxation oscillations set in. E.A.K.

N81-24648*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN INTRODUCTION TO MAGNETOSPHERIC PHYSICS BY MEANS OF SIMPLE MODELS
David P. Stern Jan. 1981 53 p refs Submitted for publication
(NASA-TM-82072) Avail: NTIS HC A04/MF A01 CSCL 04A

The large scale structure and behavior of the Earth's magnetosphere is discussed. The model is suitable for inclusion in courses on space physics, plasmas, astrophysics or the Earth's environment, as well as for self-study. Nine quantitative problems, dealing with properties of linear superpositions of a dipole and a constant field are presented. Topics covered include: open and closed models of the magnetosphere; field line motion; the role of magnetic merging (reconnection); magnetospheric convection; and the origin of the magnetopause, polar cusps, and high latitude lobes. E.A.K.

N81-24649*# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
ELECTRODYNAMIC STUDIES OF UPPER AND LOWER ATMOSPHERIC COUPLING Report, Jan. - Dec. 1980
Y. T. Chiu, J. M. Cornwall, B. C. Edgar, M. Schulz, and L. R. Sharp 1 Mar. 1981 85 p refs
(Contract NASw-3327)
(NASA-CR-163883; ATR-81(7875)-2) Avail: NTIS HC A05/MF A01 CSCL 04A

Theoretical interprotations and data interpretations of electrodynamical studies in upper and lower atmosphere coupling are reported. The following topics are discussed: (1) magnetosphere/ionosphere/atmosphere coupling in auroral electrodynamics; (2) middle atmosphere electrodynamics; (3) thermosphere troposphere coupling; and (4) tropospheric electrodynamics. Understanding of the near Earth space environment shows the interrelationships between various components of the Earth's atmosphere. E.A.K.

N81-24650*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
MEASUREMENT OF HO2 AND OTHER TRACE GASES IN THE STRATOSPHERE USING A HIGH RESOLUTION FAR INFRARED SPECTROMETER AT 28 km Semiannual Status Report, 1 Jan. - 15 Jun. 1981
Wesley A. Traub May 1981 10 p refs
(Grant NsG-5175)
(NASA-CR-164354; SASR-8) Avail: NTIS HC A02/MF A01 CSCL 04A

A progress report and data analyses from the December 1980 flight are presented. The following areas are covered: (1) computer analysis of the flight spectra to obtain phase corrected, normalized sums of spectra for retrieval of atmospheric profiles; (2) study of atmospheric HF, HCl, and H2O; (3) stratospheric H2O2 and HOCl; (4) laboratory spectroscopy of HOCl; and (5) design study of a new balloon gondola. The majority of the flight data were taken in the low background mode, i.e., one input to the spectrometer looking at the sky and the other looking at a LN2 temperature blackbody. An analysis of HF stratospheric measurements was undertaken in conjunction with the HF analysis. High quality spectra showing the HOCl q-branches under optically thin conditions were also obtained. E.A.K.

N81-24651*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AVE-SEASAME 5: 25-MB SOUNDING DATA
Meta E. Sienkiewicz (Tex. A and M Univ., College Station), Luke P. Gilchrist (Tenn. Univ., Tullahoma), and Robert E. Turner May 1981 413 p refs
(NASA-TM-82417) Avail: NTIS HC A18/MF A01

The rewinsonde sounding program for the AVE-SESAME 5 experiment is described and tubulated data at 25 mb intervals are presented for the 23 National Weather Service stations and 20 special stations participating in the experiment. Soundings were taken at 3-hr intervals beginning at 1200 GMT on May 20, 1979, and ending at 1200 GMT on may 21, 1979 (nine sounding times). A tenth sounding was teken at many special stations between 2100 and 0000 GMT on May 20. The method of processing is discussed, estimates of the rms errors in the data are presented, and an example of contact data is given. Reasons are given for the termination of soundings below 100 mb, and soundings with abnormal characteristics are listed. A.R.H.

N81-24652# Utah State Univ., Logan. Electro-Dynamics Lab.
NEAR INFRARED SPECTROMETRIC AIRGLOW MEASUREMENTS DURING THE TOTAL SOLAR ECLIPSE OF 26 FEBRUARY 1979 Final Report, 2 Feb. 1972 - 31 Jul. 1980
W. R. Pendleton, Jr., D. J. Baker, and A. J. Steed 15 Jan. 1981 37 p refs
(Grant AF-AFOSR-0040-79; AF Proj. 2310)
(AD-A098108; AFOSR-81-0347TR) Avail: NTIS HC A03/MF A01 CSCL 03/3

Spectrometric airglow measurements during the solar eclipse of 26 February 1979 have yielded first-of-a-kind residual airglow spectra during the total phase of the eclipse. The temporal variations of the O2 infrared atmospheric features and the He multiplet at 1.083 microns are consistent with current excitation/emission models; however, the OH Meinel emission levels decreased almost monotonically by totality, in contrast with expectations based on most code predictions. Twilight transition, nightglow and auroral data were also acquired to characterize airflow conditions during the general timeframe of the eclipse. The twilight-transition results compare favorably with similar earlier measurement by other investigators. Author (GRA)

N81-24653# Naval Research Lab., Washington, D. C.
CONVECTIVE COOLING OF LIGHTNING CHANNELS
J. M. Picone, J. P. Boris, R. F. Fernsler (Jaycor, Alexandria, Va.), J. R. Greig, and M. Raleigh 14 Apr. 1981 29 p refs
(ARPA Order 3718; RR0330244)
(AD-A097994; NRL-MR-4472) Avail: NTIS HC A03/MF A01 CSCL 04/1

We report experimental data which trace the time development of electric discharge channels in air and which demonstrate the turbulent cooling of such channels. These data provide qualitative confirmation of the model proposed and used by Hill, Ranker, and Wilson to calculate the production of nitrogen oxides by lightning. We outline an analytical treatment which identifies asymmetries in the pressure and density gradients of the discharge channel as a significant source of velocity. The vorticity, in turn, causes ambient air to mix into the channel. Out theoretical analysis results in equations from which the vorticity strength and mixing time scale may be calculated. We briefly describe detailed simulations with which we have calibrated the theory. Finally, we combine the experimental data with our calibrated formulas to estimate the convective mixing rate in the case of lightning. We obtain a rate of about 300 cc/sec/cc air in the return stroke channel after pressure equilibrium has been achieved. GRA

N81-24654# Research, Analysis and Development Corp., Colorado Springs, Colo.
RAPID RESPONSE DENSITY PROBE FABRICATION AND TESTING Final Report
Robert A. Golobic Kirtland AFB, N. Mex. AFWL Feb. 1981 87 p refs
(Contract F29601-78-C-0072)
(AD-A098040; AD-E200678; AFWL-TR-80-58) Avail: NTIS HC A05/MF A01 CSCL 14/2

A new air density measuring probe has been manufactured and tested. The measurement technique is based upon measurement of the energy decay of radioactive alpha particles as they transverse the air. The probe consists of an alpha particle source, a detector, and signal processing electronics. The system is designed to measure high frequency (up to 20 kHz) density fluctuations as well as mean density. Testing was performed using a low speed heated jet. Accurate mean density measurements were demonstrated. However, noise in the processing electronics prevented accurate unsteady readings. GRA

N81-24655# Naval Postgraduate School, Monterey, Calif.
CHARACTERISTICS OF GEOMAGNETIC POWER SPECTRA ON LAND AND SEA IN THE PERIOD RANGE 0.2 TO 400 SECONDS M.S. Thesis
Gary M. McKinley and Robert M. Santos Dec. 1980 93 p refs
(AD-A098044) Avail: NTIS HC A05/MF A01 CSCL 08/14

Geomagnetic field fluctuations in the 0.025-5 Hz range were measured with a Cesium vapor magnetometer on the sea floor in Monterey Bay, and at a remote land site. Correlation was found between the geomagnetic activity A-index and both the slope and relative magnitude of the power spectra. More active days showed a greater fall-off as frequency increased, and a higher level of the observed power spectra. Fluctuations averaging 0.1n (sq T)/Hz were noted at the low frequencies, dropping to 0.00001n (sq T)/Hz at 1 Hz. Comparisons were made between the land/sea and day/night data to determine the sea and diurnal effects. In addition to swell induced fluctuations, the overall power spectra for sea data is 10-15 dB higher than land data. Diurnal shifts indicate a 20 second period increase in the nighttime Pc 3 fluctuations. Daytime intensity is generally 5 dB above the nighttime data, but with a crossover at 0.05Hz, the nighttime data then running 3 to 5 dB above the day. Further observations

were made to determine the applicability of the magnetometer for non-seismic detection of nuclear blast. Author (GRA)

N81-24656# Naval Research Lab., Washington, D. C.
DIRECT MEASUREMENTS OF ELECTRON DENSITY, TEMPERATURE AND ION COMPOSITION IN AN EQUATORIAL SPREAD-F IONOSPHERE Interim Report
R. S. Narcisi and E. P. Szuszczewicz 17 Mar. 1981 39 p refs
(RR0330244)
(AD-A097875; NRL-MR-4445) Avail: NTIS HC A03/MF A01 CSCL 04/1

Ionospheric plasma irregularities have been studied on each of two rockets launched into significantly different conditions of equatorial spread-F. In the first operation (into a spread-F decay phase) a number of major depletions were distributed throughout the F-region from its bottomside gradient centered near 260 kilometers, through the F-peak, to a topside altitude of 500 kilometers. In a second operation (launched into a mid-phase development of spread-F) irregularities were observed only on the bottomside gradient, with no depletions in or above the F-peak. Author (GRA)

N81-24657# Boston Coll., Chestnut Hill, Mass. Space Data Analysis Lab.
STRUCTURE OF THE UPPER ATMOSPHERE Final Report, 1 Jan. 1977 - 31 Dec. 1980
Jeffrey M. Forbes 1 Mar. 1981 20 p refs
(Grant AF-AFOSR-3223-77; AF Proj. 2310)
(AD-A098061; AFOSR-81-0349TR) Avail: NTIS HC A02/MF A01 CSCL 04/1

Initial efforts during the 4 year period of this grant involved investigations of the seasonal-latitudinal structure of the diurnal thermospheric tide and the thermospheric extensions of semidiurnal tides excited below 100 Km using a numerical model which realistically simulates dissipative processes. This work, combined with a calculation of the in-situ semidiurnal thermospheric tide, led to construction of a synthesized model of diurnal and semidiurnal temperatures and winds calibrated with incoherent scatter radar observations. This model was subsequently utilized to investigate tidal variations in thermospheric composition and the generation of electric fields and currents due to dynamo action in the E region. A rotating plane equivalent gravity wave formalism was also developed to more efficiently compute thermospheric tidal structures, and utilized to investigate the damping effect of O-N(2) mutual diffusion on thermospheric tides, and the mutual coupling between tides and turbulence in the mesosphere. Work under this grant formed an important contribution to a comprehensive review of theoretical studies of atmospheric tides written for Review of Geophysics and Space Physics in 1979. Finally, significant effects of tidal variations in temperature and density on the hydrated positive ion chemistry of the D region have been discovered, thus explaining some important aspects of the asymmetric and seasonal-latitudinal behavior of the D region. GRA

N81-24658# Boston Coll., Chestnut Hill, Mass. Space Data Analysis Lab.
IONOSPHERIC ELECTRON DENSITY PROFILE AND RELATED STUDIES Final Report, 22 Nov. 1977 - 30 Sep. 1980
Bamandas Basu, Tien S. Chang, and Ed. R. Smith 3 Feb. 1981 59 p refs
(Contract F19628-77-C-0243; AF Proj. 1924)
(AD-A097712; BC-SDAL-81-1; AFGL-TR-81-0021) Avail: NTIS HC A04/MF A01 CSCL 04/1

There are many problems of practical interest in the study of the Earth's ionosphere that require a detailed knowledge of the electron energy distribution and the electron density profile. This report summarizes our theoretical efforts in explaining the observed electron distribution functions. Boltzmann-Fokker-Planck theory has been used, and the resulting kinetic equation has been analyzed. A systematic study of the collision operators that appear in the kinetic equation has been done. Electrostatic plasma instabilities have been investigated in order to explain the observed anomalous structure of the electron energy distribution in the 2-4 eV range. In a related study, the problem of auroral proton precipitation has been solved analytically. The analysis enables us to calculate the precipitating proton hydrogen fluxes, energy deposition rate, and the electron density profile resulting from ionization. GRA

N81-24659# Emmanuel Coll., Boston, Mass.
AURORAL X-RAY CONTAMINATION OF THE LOW ENERGY PROTON SPECTROMETER ON THE S3-2 SATELLITE IN THE POLAR REGIONS Progress Report, 1 Jan. - 31 Aug. 1980
Richard P. Boyle and Daniel R. Parsignault Hanscom AFB, Mass. Air Force Geophysics Lab. 31 Jan. 1981 32 p refs
(Contract F19628-79-C-0102; AF Proj. 2311)
(AD-A097713; SR-2; AFGL-TR-80-0265) Avail: NTIS HC A03/MF A01 CSCL 04/1

The Low Energy Proton Spectrometer (LEPS) on board the Air Force S3-2 polar orbiting satellite recorded, at polar latitudes, high anomalous counts coming from the auroral zone direction, over the December 1975 through April 1976 operational period. Despite the low sensitivity of the Si(Li) LEPS detector to X-rays, bremsstrahlung from precipitating electrons in the hundred keV energy range is given as the source of these observations. GRA

N81-24660# Geological Survey, Denver, Colo.
PRINCIPAL FACTS, ACCURACIES, SOURCES, AND BASE STATION DESCRIPTIONS FOR GRAVITY STATIONS IN THE NEVADA PART OF THE GOLDFIELD AND MARIPOSA 2 DEG SHEETS
D. L. Healey, R. R. Wahl, and F. E. Currey Mar. 1981 15 p refs
(Contract DE-AI08-76DP-00474)
(USGS-474-311) Avail: NTIS HC A02/MF A01

The data from gravity observations, after conversion to the International Gravity Standardization Network are compiled. Data acquisition and accuracies are discussed. DOE

N81-24661# Bureau of Mines and Geology, Moscow, Idaho. Dept. of Lands.
REVIEW OF THE UPPER CENOZOIC STRATIGRAPHY OVERLYING THE COLUMBIA RIVER BASALT GROUP IN WESTERN IDAHO
William B. Strowd Richland, Wash. Rockwell International Dec. 1980 87 p refs
(Contract DE-AC06-77RL-01030)
(BM-RHO-BWI-C-87) Avail: NTIS HC A05/MF A01

Information currently available on the rocks that stratigraphically overlie the Columbia River Basalt Group in Idaho is summarized. A brief but comprehensive review of the literature available on upper Cenozoic rocks in western Idaho is given and their general stratigraphic relationships discussed. The derivation of the present stratigraphy and weaknesses noted in present understanding of the geology and stratigraphy. The feasibility of nuclear waste storage in the Columbia River Basalt Group of the Pasco Basin, Washington is discussed. DOE

N81-24662# Los Alamos Scientific Lab., N. Mex.
ELECTRON PROBE MICROANALYSIS IN GEOSCIENCES: A TUTORIAL
R. Gooley 1981 25 p refs Presented at Scanning Electron Microscopy/1981, Dallas, 14-18 Apr. 1981
(Contract W-7405-eng-36)
(LA-UR-80-3680; CONF-810310-1) Avail: NTIS HC A02/MF A01

A tutorial on the history, theory, and use of electron probe microanalysis in the geosciences is presented. DOE

N81-24663# Wuppertal Univ. (West Germany). Dept. of Physics.
SOUNDING ROCKET PROGRAM AERONOMY. UPPER POLAR ATMOSPHERE PROJECT. MEASUREMENTS BY THE INFRARED SPECTROMETER AB 3 Final Report
Klaus Ulrich Grossmann, Dirk Offerman, und Juergen Scheer Bonn Bundesministerium fuer Forschung und Technologie Jun. 1980 39 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung ung Technologie
(BMFT-FB-W-79-43; ISSN-0170-1339) Avail: NTIS HC A03/MF A01

A rocket-borne grating spectrometer system for measuring

the fine structure of the 63 micron atomic oxygen transition is described. Thermodynamic equilibria and water vapor concentrations can be determined from these measurements. The system employs an Ebert-Fastie spectrometer. The low signal-to-noise ratio associated with the very low intensities studied led to the use of He cooling. A chopper filter system with ac amplification was employed. Intensity profile measurements lead to the conclusion that fine structure atomic oxygen levels are not in local thermodynamic equilibrium throughout the thermosphere. Upper limits of the lower thermosphere water vapor concentrations are deduced from the measured intensities Author (ESA)

N81-24664# Research Inst. of National Defence, Stockholm (Sweden).

INTERNATIONAL SEISMOLOGICAL DATACENTER. DATABASE STRUCTURE, COMPUTER FACILITIES, AUTOMATIC AND INTERACTIVE ANALYSIS

Gunnel Barkeby Nov. 1980 58 p refs

(FOA-C-20381-T1) Avail: NTIS HC A04/MF A01

A data base and data analysis system were designed for receiving and processing seismological data from the WMO Global Telecommunications System. The interface with the system uses a PDP 11/34 computer. Data from the seismic bulletins can be analyzed online or stored for later use. The data base is constructed on a list basis and is a set of seismological data consisting of either reported or calculated parameters. Each parameter is accessible to the user. Programming for the system is in standard FORTRAN except for the communications interface. Record structure is shown with examples of the command language. Computer equipment includes an Amdahl 470/V7, a DEC 10, and a CDC 170-720 Author (ESA)

N81-24665# Research Inst. of National Defence, Stockholm (Sweden).

INTERNATIONAL SEISMOLOGICAL DATACENTER. AUTOMATIC ASSOCIATION OF LONG PERIOD SURFACE WAVE DATA

Ingvar Jeppsson Nov. 1980 31 p refs

(FOA-C-20385-T1) Avail: NTIS HC A03/MF A01

An automatic procedure for association of surface waves to defined seismic events is presented. A signal is accepted as associated to an event if the observed arrival time falls within a specified time window around the theoretical arrival time. The theoretical arrival times are calculated from the origin time of the event and the theoretical travel times of the waves from the event to the recording stations. Surface waves are assumed to follow great circle paths. The procedure was tested on surface wave data from a four day period giving good results. About two thirds of all reported surface wave signals were associated and about half of all events were assigned a surface wave magnitude. This magnitude was estimated by using observed signal values and, from stations without observed signals, actual noise values. The event magnitude estimated in this way compares with the station magnitudes and turns out to be a good method of verification of the associations. Author (ESA)

N81-24666# Prakla-Seismos G.m.b.H., Hannover (West Germany).

DEVELOPMENT OF A TELEMETRY SYSTEM FOR SEISMIC APPLICATIONS Final Report

Hans Edelmann Bonn Bundesministerium fuer Forschung und Technologie Oct. 1980 39 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-80-122; ISSN-0340-7608) Avail: NTIS HC A03/MF A01

A telemetry system for seismic field measurement is described. The system handles measurement data acquisition as well as processing by specialized programs. The choice of measuring equipment is recounted and related to the elaboration of a detection scheme. The data processing format is discussed. The procurement and setup of field equipment are described. The methodological problem of suppressing interference signals is treated. The testing and qualification of the system for field data gathering applications is proposed. The carrying out of this program is reported on. Quality control of processed measurement data shows that the system fully meets operational requirements. Author (ESA)

N81-24667# Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.

SOUNDING ROCKET PROGRAM AERONOMIE. PROJECT POLAR UPPER ATMOSPHERE: MAGNETOMETER EXPERIMENT Final Report

Burkhard Theile and Hermann Luehr Bonn Bundesministerium fuer Forschung und Technologie Oct. 1980 62 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-W-80-025; ISSN-0170-1339) Avail: NTIS HC A04/MF A01

A vector magnetometer was designed and built which measures the magnetic field of ionospheric and field aligned currents. Wide dynamic range and digital data output were sought. Four successful rocket flights were made during periods of magnetospheric substorm activity. The geophysical launch conditions and data on the trajectories are reported. Results from all four flights confirm the correct functioning of the magnetometer payloads, and implications of the data in relation to the reference magnetic field are discussed. The determination of transversal magnetic field variation during an aurora event is shown as an example. Author (ESA)

N81-24668# Danish Meteorological Inst., Copenhagen.

HIGH LATITUDE IONOSPHERIC CURRENTS

E. Friis-Christensen 1980 20 p refs Presented at NATO Advan. Study Inst. on Exploration of the Polar Upper Atmosphere, Lillehammer, Norway, 5-16 May 1980 Sponsored in part by Danish Space Research Board and UK Science Research Council

(R-63; ISBN-87-7478-181-2) Avail: NTIS HC A02/MF A01

Very high latitude magnetic variations and their relation to ionospheric and field aligned currents are summarized. The region inside the auroral zone, comprising the polar cap and the projection into the ionosphere of the polar cusp, is described. The observed magnetic perturbation vector, reckoned from the undisturbed level, is discussed and observations explained. Magnetometer data from inside the auroral oval show that the ionospheric currents are structured in three regions. Counted from the equatorward, these are: the closed field line region, characterized by the eastward and westward electrojets; the intermediate region, supposed to be connected to the solar wind magnetic field through the boundary layer magnetic field lines; and the tail lobe field line region, the most poleward region showing a smoother sinusoidal daily variation of the horizontal perturbation field. Surface magnetometer data and data from the HEOS 2 satellite indicate the presence of a permanent two cell equivalent current system independent of the interplanetary magnetic field. A recent model of the high latitude three dimensional current configuration is supplemented with observations of magnetic perturbations at very high latitudes. Author (ESA)

N81-24669# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

A METHOD TO MINIMIZE THE ERROR IN DETERMINING THE DOPPLER SHIFT OF A SODAR ECHO [METODO PER MINIMIZZARE L'ERRORE NELLA DETERMINAZIONE DELLA DERIVA DOPPLER DI UN ECO SODAR]

G. Mastrantonio Dec. 1980 42 p refs In ITALIAN Sponsored by Commissione of European Communities and CNR

(LPS-80-20) Avail: NTIS HC A03/MF A01

A digital technique for the extraction of Doppler shift data from SODAR echoes in planetary boundary layer studies is described. After the harmonic analysis of the digitized signal, the characteristics of the echo are determined in a limited spectral zone. It is shown that the errors due to noise are considerably reduced by limiting the analysis to the spectral region in which the echo is found. Author (ESA)

N81-24670# Royal Netherlands Meteorological Inst., De Bilt.

SEISMOLOGICAL BULLETIN OF THE SEISMOGRAPH STATIONS IN THE NETHERLANDS, VOLUME 64, 1976

1980 138 p

(KNMI-108-64) Avail: NTIS HC A07/MF A01

Data from the seismographs at De Bilt, Heerlen, and Witteveen, Netherlands, are given. The situation of the stations is shown, and characteristics of the instrumentation are detailed. The character of microseismic activity for the period is included.

Seismic records, relating date, phase, G.M.T., first motion, period, amplitude, and magnitude of seismic events, are presented in tabular form. Of particular note is the seismic record of the catastrophic earthquake in China, July 27, 1976. Author (ESA)

N81-24671# Stockholm Univ. (Sweden). Inst. of Meteorology.

A NONLINEAR BALANCE EQUATION WITH OROGRAPHIC EFFECTS INCLUDED APPLIED TO THE WHOLE GLOBE

Aake Johansson Dec. 1980 27 p refs

(Contract G-2923-100)

(DM-32) Avail: NTIS HC A03/MF A01

The nonlinear surface pressure weighted balance equation was applied to the whole globe. The finite difference analog to the original equation expressed in spherical coordinates was applied to a latitude longitude grid with sigma = P/Ps as the vertical coordinate. The equation was solved over the whole globe for nondivergent pi-weighted wind when the mass field is given. In order to get a solution near or at the equator, where the original second order partial differential equation degenerates, three different methods were investigated. Only one gives a solution for all the different mass fields given. This method prescribes the equator to be a streamline, thus excluding cross-equatorial flow, and uses this streamline as boundary values for the Northern and Southern hemispheres. This method yields a clear and correctly posed mathematical problem, with the two other proposed methods being ambiguous. The resulting wind field when a mountain is introduced seems to be in agreement with theoretical solutions for the same scale of the mountain for flow on an f-plane. A limited area version of the spherical model was also developed, where the stream function at the boundaries is given instead. Author (ESA)

N81-24672# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Civil Engineering.

A STUDY OF THE ENGINEERING CHARACTERISTICS OF THE 1971 SAN FERNANDO EARTHQUAKE RECORDS USING LINE DOMAIN TECHNIQUES

William E. Bond, Richardo Dobry, and Michael J. ORourke Jun. 1980 182 p refs

(Grant NSF PFR-79-02871)

(PB81-150310; CE-80-1; NSF/RA-800304) Avail: NTIS HC A09/MF A01 CSCL 08K

Accelerograms recorded at ground elevation during the 1971 San Fernando, California earthquake were examined by four time domain technqiues: (1) the Husid plot of energy buildup; (2) root mean square acceleration; (3) principal planes of ground motion; and (4) the response envelope of a simple degree of freedom system. Through use of these techniques a part of the accelerograms that includes arrival of S-waves from the source was identified computationally. Horizontal plane root mean square acceleration was used to provide a measure of the level of shaking which is indepent of the orientation of the recording devices. Attenuation of the root mean square acceleration with distance was generally consisted with an equation which relates the root mean square acceleration with the earthquake source parameters. A traveling Rayleigh wave was identified at two deep soil sites. GRA

N81-24673# International Geophysical Year World Data Center A, Boulder, Colo.

ICE CORES

P. K. MacKinnon, comp. May 1980 146 p refs

(PB81-149577; GD-8; NOAA-80110707; ISSN-0149-1776) Avail: NTIS HC A07/MF A01 CSCL 08L

A two year project relating to ice core data was carried out. Most of the ice cores so far collected are documented on a world-wide basis. Information is provided on literature sources and on the current status of research activities which affect the types of data than can be archived. The characteristics and structure of the World Data Center's data base system for ice core data are also described. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N81-24674* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

GLOBAL ANALYSIS OF JANUARY AND JULY SEA LEVEL PRESSURE

R. V. Godbole (NAS/NRC) and J. Shukla Feb. 1981 73 p refs Submitted for publication

(NASA-TM-82097) Avail: NTIS HC A04/MF A01 CSCL 04B

A global analysis of monthly mean sea level pressure for January and July over a 16 year period (1961 through 1976) is presented. For both hemispheres, the summer circulation is characterized by continental lows and oceanic highs. The prominent features of the Northern Hemispheric winter circulation, forced by diabatic heat sources and orography, are Aleutian low, Icelandic low and Siberian high. The interannual variability is small over the tropics and large over the extratropics. Maximum variability occurs over the locations of Icelandic and Aleutian lows in the Northern Hemispheric winter. The locations and intensities of the Southern Hemispheric subtropical highs, which occur over the oceans, are remarkably similar in January and July and show small interannual variability. The north Atlantic and south Atlantic subtropical highs attain their maximum intensity at the same time, during July. E.A.K.

N81-24675 Minnesota Univ., Minneapolis.

WINDS AND TURBULENCE NEAR THE TOP OF THE PLANETARY BOUNDARY LAYER FROM BALLOON MEASUREMENTS Ph.D. Thesis

Gregory Dale Nastrom 1980 130 p

Avail: Univ. Microfilms Order No. 8109481

An analytic solution to the balloon's equation of vertical motion is presented, based on routine expansion methods and taking account of both wind and density variations, such as expected in a gravity wave. This solution is useful for studying expected balloon response to single wave disturbances; but in most cases a whole spectrum of atmospheric motions is encountered and a simple numerical integration scheme was actually used to find vertical air motions from vertical balloon motions for 38 tetroon flights with float levels near 1 km. For spectral periods greater than about 10 minutes, vertical motions and variability are much larger for the retrieved air motions than would be found simply using vertical balloon motions, also, the sign of the Reynold's stress is often different when based on retrieved vertical air motions. These results suggest only retrieved vertical air motions can be used for studies of gravity waves or vertical fluxes using balloon data. Dissert. Abstr.

N81-24676 Washington Univ., Seattle.

ON THE DYNAMICS OF COASTAL WINDS Ph.D. Thesis

Robert Michael Reynolds 1980 184 p

Avail: Univ. Microfilms Order No. 8109765

The transition of an offshore flow, from land to ocean, was studied. Observations were taken over several years near the Malaspina Glacier on the south coast of Alaska. Upper air soundings in the breach reveal a complicated process whereby coastal air flows under the marine boundary layer and subsequently is absorbed into it by entrainment and warming. A layer averaged, numerical model was developed to help discern the dominant physics. Entrainment at the top of the layer is parameterized with contributions from buoyancy flux, surface shear, and interfacial shear. Fluxes of momentum, heat, and vapor at the surface are parameterized with bulk transfer coefficients, corrected for layer stability and surface roughness. A two dimensional version of the model was applied to offshore flow and rapid transition was easily confirmed. All three components of entrainment can be important, thus the effect is not strongly dependent on sea-air temperature difference. Baroclinity in the layer, a result of offshore warming, contributes strongly to the dynamic balance and often creates a supergeostrophic surface wind for long distances offshore. Dissert. Abstr.

N81-24677 Deutscher Wetterdienst, Offenbach am Main (West Germany).

POSSIBILITY OF CLIMATE CLASSIFICATION THROUGH THE TWOFOLD APPLICATION OF FACTOR ANALYSIS [MOEGLICHKEITEN EINER KLIMAKLASSIFIKATION MIT HILFE DER ZWEIMALIGEN ANWENDUNG DER FAKTOREN-ANALYSE]

Ludwig Hoffmann 1980 103 p refs In GERMAN; ENGLISH summary

(ISBN-3-88148-183-4; ISSN-0072-4130) Avail: Issuing Activity

Raw data evaluated are daily mean values for the zonal and meridional wind component, temperature, water vapor pressure, and precipitation for selected stations of the Federal Republic of Germany from 1950 to 1960. The dependence of the climatic elements, as derived by factor analysis, separately for every month and every station, is shown. Results of synoptic climatic classification show four climatic regions within Germany, the spatial time series of which varies with the different months. Meteorological significance is demonstrated by review of classic climatological surveys. Author (ESA)

N81-24678*# Tennessee Univ. Space Inst., Tullahoma. Atmospheric Science Div.

NUMERICAL SOLUTIONS OF ATMOSPHERIC FLOW OVER SEMIELLIPTICAL SIMULATED HILLS Interim Report

Chih Fang Shieh and Walter Frost Washington NASA Jun. 1981 137 p refs

(Contract NAS8-32692)

(NASA-CR-3430) Avail: NTIS HC A07/MF A01 CSCL 04B

Atmospheric motion over obstacles on plane surfaces to compute simulated wind fields over terrain features was studied. Semiellipticai, two dimensional geometry and numerical simulation of flow over rectangular geometries is also discussed. The partial differential equations for the vorticity, stream function, turbulence kinetic energy, and turbulence length scale were solved by a finite difference technique. The mechanism of flow separation induced by a semiellipse is the same as flow over a gradually sloping surface for which the flow separation is caused by the interaction between the viscous force, the pressure force, and the turbulence level. For flow over bluff bodies, a downstream recirculation bubble is created which increases the aspect ratio and/or the turbulence level results in flow reattachment close behind the obstacle. E.A.K.

N81-24679*# Tennessee Univ. Space Inst., Tullahoma. Atmospheric Science Div.

AIRPLANE WING VIBRATIONS DUE TO ATMOSPHERIC TURBULENCE Interim Report

Robert L. Pastel, John E. Caruthers, and Walter Frost Washington NASA Jun. 1981 84 p refs

(Contract NAS8-32692)

(NASA-CR-3431) Avail: NTIS HC A05/MF A01 CSCL 04B

The magnitude of error introduced due to wing vibration when measuring atmospheric turbulence with a wind probe mounted at the wing tip was studied. It was also determined whether accelerometers mounted on the wing tip are needed to correct this error. A spectrum analysis approach is used to determine the error. Estimates of the B-57 wing characteristics are used to simulate the airplane wing, and von Karman's cross spectrum function is used to simulate atmospheric turbulence. It was found that wing vibration introduces large error in measured spectra of turbulence in the frequency's range close to the natural frequencies of the wing. E.A.K.

N81-24680*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

A PRELIMINARY LOOK AT AVE-SESAME 5 CONDUCTED ON 20-21 MAY 1979

Michael J. July (Texas A & M Univ., College Station) and Robert E. Turner May 1981 64 p ref

(NASA-TM-82416) Avail: NTIS HC A04/MF A01 CSCL 04B

Information on data collected, synoptic conditions, and severe and unusual weather reported during the period are presented. Records of the synoptic conditions include synoptic charts, radar charts, satellite photographs, and rainfall observations. T.M.

N81-24681*# City Univ. of New York, N. Y.

THE THERMAL INFLUENCE OF CONTINENTS ON A MODEL-GENERATED JANUARY CLIMATE

J. Spar, C. Cohen, and P. Wu Jun. 1981 34 p refs

(Grant NGR-33-016-086)

(NASA-CR-164197) Avail: NTIS HC A03/MF A01 CSCL 04B

Two climate simulations were compared. Both climate computations were initialized with the same horizontally uniform state of rest. However, one is carried out on a water planet (without continents), while the second is repeated on a planet with geographically realistic but flat (sea level) continents. The continents in this experiment have a uniform albedo of 0.14, except where snow accumulates, a uniform roughness height of 0.3 m, and zero water storage capacity. Both runs were carried out for a 'perpetual January' with solar declination fixed at January 15. T.M.

N81-24682*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SEASAT: - JASIN WORKSHOP REPORT. VOLUME 1: FINDINGS AND CONCLUSIONS

Dec. 1980 408 p refs

(NASA-CR-164360; JPL-Pub-80-62-Vol-1) Avail: NTIS HC A18/MF A01 CSCL 04B

Data acquired from the Joint Air-Sea Interaction (JASIN) Experiment and Seasat data from overpasses that covered the JASIN area were compared and evaluated. The JASIN data were used as a high quality withheld data set. The Seasat data were prepared for each instrument: the Seasat-A Satellite Scatterometer (SASS), the Scanning Multichannel Microwave Radiometer (SMMR), and the synthetic aperture radar (SAR). The following results demonstrate the performance of Seasat: it was possible to identify mesoscale systems with the SASS as well as fronts; the SMMR provided accurate water vapor content of the atmosphere; the SAR showed evidence of helical rolls in the marine boundary layer; a SASS anomaly could be traced back to thunderstorm activity. J.M.S.

N81-24683*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

WIND SPEED STATISTICS FOR GOLDSTONE, CALIFORNIA, ANEMOMETER SITES

M. Berg, R. Levy, H. McGinness, and D. Strain 15 Apr. 1981 73 p ref Sponsored by NASA

(NASA-CR-164364; JPL-Pub-81-17) Avail: NTIS HC A05/MF A01 CSCL 04B

An exploratory wind survey at an antenna complex was summarized statistically for application to future windmill designs. Data were collected at six locations from a total of 10 anemometers. Statistics include means, standard deviations, cubes, pattern factors, correlation coefficients, and exponents for power law profile of wind speed. Curves presented include: mean monthly wind speeds, moving averages, and diurnal variation patterns. It is concluded that three of the locations have sufficiently strong winds to justify consideration for windmill sites. E.A.K.

N81-24684*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ICE CONDITIONS ON THE CHESAPEAKE BAY AS OBSERVED FROM LANDSAT DURING THE WINTERS OF 1977, 1978 AND 1979

James L. Foster Mar. 1980 36 p refs Submitted for publication

(NASA-TM-80657) Avail: NTIS HC A03/MF A01 CSCL 04B

The LANDSAT observations during the winters of 1977, 1978 and 1979, which were unusually cold in the northeastern U.S. and in the Chesapeake Bay area, were evaluated. Abnormal atmospheric circulation patterns displaced cold polar air to the south, and as a result, the Chesapeake Bay experienced much greater than normal icing conditions during these 3 years. The LANDSAT observations of the Chesapeake Bay area during these winters demonstrate the satellite's capabilities to monitor ice growth and melt, to detect ice motions, and to measure ice extent. E.A.K.

N81-24685# Naval Environmental Prediction Research Facility, Monterey, Calif.

FREQUENCY OF ADVERSE WEATHER CONDITIONS AFFECTING HIGH ENERGY LASER SYSTEMS OPERATIONS Final Report

Andreas K. Goroch and Terry Brown Nov. 1980 126 p refs
(AD-A098031; NEPRF-TR-80-06) Avail: NTIS HC A07/MF A01 CSCL 04/2

The planning of high energy laser system operations depends on a knowledge of possible environmental parameters likely to affect the system. Most basically, the planner needs to know the probability that the system will be usable because of adverse weather conditions. The most fundamental environmental conditions inhibiting laser use are high rain rates and low visibility due to fog, haze or dust. This report calculates the frequency of occurrence of these conditions as a function of geographic location. The geographical locations chosen were those which may have possible laser operations, and include the Persian Gulf, North Atlantic, Mediterranean, Southeast Asia, Korea, and the Caribbean Sea. With a limiting 3 hour average rate rate of 3 mm/hr, the frequency of occurrence of the rain limitation is no greater than 3%. This depends on latitude - higher latitudes having lesser rain rates - as well as time of year. The limiting visibility condition was considered to be 1 km. Visibility less than 1 km was generally related to fog and as such is also related to latitude. In the tropical areas the visibility limitation occurred less than 1% of the time regardless of time of year. In polar and subpolar locales, limited visibility occurred over 20% of the time (Kamchatka, in July). Author (GRA)

N81-24686# University Coll., London (England). Dept. of Physics and Astronomy.

TROPOSPHERIC: STRATOSPHERIC TIDAL INVESTIGATIONS. PART 1: HOUGH COMPONENTS OF WATER VAPOUR HEATING Final Scientific Report, 1 Dec. 1976 - 30 Apr. 1981

G. V. Groves 31 Dec. 1980 73 p refs
(Grant AF-AFOSR-3224-77)
(AD-A098041; AFGL-TR-81-0106(1)) Avail: NTIS HC A04/MF A01 CSCL 04/2

Formulae are derived for the Hough components and mean rate of isolational heating by water vapour absorption in an atomosphere with cloud-related scattering properties. Global models of specific humidity and cloud amount are adopted for the months of January, April, July, and October and used in conjunction with adopted values of surface albedo, absorption coefficients and scattering parameters to evaluate diurnal and semi-diurnal components of heating for migrating modes. The inclusion of cloud scattering has the notable effect of nearly doubling heating rates at 8 km altitude and of halving values near the surface. A number of non-migrating components associated with the principal diurnal and semi-diurnal modes have also been evaluated. GRA

N81-24687# University Coll., London (England). Dept. of Physics and Astronomy.

TROPOSPHERIC: STRATOSPHERIC TIDAL INVESTIGATIONS. PART 2: THE VERTICAL STRUCTURE OF ATMOSPHERIC OSCILLATIONS FORMULATED BY CLASSICAL TIDAL THEORY Final Scientific Report, 1 Dec. 1976 - 30 Apr. 1981

G. V. Groves 28 Feb. 1981 85 p refs
(Grant AF-AFOSR-3224-77)
(AD-A098042; AFGL-TR-81-0106(2)) Avail: NTIS HC A05/MF A01 CSCL 04/2

From the equations of classical tidal theory with Newtonian cooling (Chapman and Lindzen, 1970), formulae are obtained for wind, temperature and pressure oscillations generated by thermal, gravitational, and lower-boundary excitations of given frequency. The analysis is an extension of that of Butler and Small (1963) who formulated solutions of the vertical structure equation in terms of two independent solutions of the homogeneous equation and derived expressions for surface pressure oscillations. Computational procedures are described for obtaining two independent solutions of the homogeneous equation and results are presented for an adopted profile of atmospheric scale height. The problem of deriving the surface pressure oscillation due to a tidal potential is briefly reviewed and results are presented as an example of the application of formulae that have been derived. Author (GRA)

N81-24688# Systems and Applied Sciences Corp., Riverdale, Md.

DEVELOPMENT OF AUTOMATED OBJECTIVE METEOROLOGICAL TECHNIQUES Final Report, 1 Dec. 1978 - 30 Nov. 1980

Alan M. Gerlach 30 Nov. 1980 96 p refs
(Contract F19628-79-C-0033; AF Proj. 6670)
(AD-A097718; AFGL-TR-81-0017) Avail: NTIS HC A05/MF A01 CSCL 04/2

This report summarizes weather research conducted by SASC in several areas: determining the effect on forecast accuracy of varying spatial resolution in a limited-area numerical weather prediction model; providing specialized programming support for sensor and technique testing; developing McIDAS-derived software for AWDS; developing objective techniques for estimating cloud base heights, predicting slant visual range, and predicting low-level winds; developing objective techniques for processing satellite imagery (cloud type identification, snow/cloud discriminator, brightness variation analysis); developing applications software for McIDAS; maintaining, enhancing, and operating McIDAS; developing weather radar techniques (wind retrieval technique, storm cell detection an tracking, detection of turbulence in thunderstorms using radar methods). Author (GRA)

N81-24689# SRI International Corp., Menlo Park, Calif.

SATELLITE WIND-PROFILE TECHNIQUES Final Report

Robert L. Mancuso and Roy M. Endlich Dec. 1980 69 p refs
(Contract N00228-79-C-K890)
(AD-A098094; NEPRF-CR-80-05) Avail: NTIS HC A04/MF A01 CSCL 04/2

Satellite data that are currently available in numerical form for operational use include temperature profiles and cloud-motion measurements. In this study, several different techniques were tested for possible use in deriving wind profiles from these data. The eventual application of the wind profiles would be in objective analysis and numerical weather prediction. The techniques were tested using research data sets prepared by the National Environmental Satellite Service (NESS) at the University of Wisconsin. The satellite data consist of high-resolution TIROS-N temperature profiles and GOES cloud-motion measurements. The evaluation of the techniques was based on comparisons with radiosonde observations over the United States. Two of the techniques tested were found to give promising results: one, a technique based on the use of thermal winds to extrapolate wind values upward and downward from the cloud-motion level, and the other a technique based on eigenvector calculations. These two techniques, or similar ones, should be of current operational value over oceanic areas devoid of conventional data, provided that reliable height values for cloud motions and reasonably accurate estimates of surface winds can be provided. Author (GRA)

N81-24690# Texas Univ. at Dallas. Center for Space Sciences.

STUDY OF UPPER ATMOSPHERE WIND MOTIONS Final Technical Report, 22 Jun. 1979 - 30 Sep. 1980

W. B. Hanson, N. R. Coley, and R. A. Heelis Hanscom AFB, Mass. AFGL 15 Sep. 1980 20 p
(Contract F19638-79-C-0113; AF Proj. 6690)
(AD-A097733; E1262-01; AFGL-TR-80-0307) Avail: NTIS HC A02/MF A01 CSCL 04/2

This report summarizes the efforts at UT Dallas to evaluate the crosswind measuring capability of the AFGL accelerometers (MESA's) mounted on the Atmosphere Explorer satellites. The software available for this purpose from AFGL had some limitations that prevented its use for our purposes, and much of our contract time was devoted to producing a suitable software package. Using this, we find that the wind data from all three spacecraft are probably useful, though the AE-D data are somewhat noisier than that from AE-C and AE-E. Both AE-D and AE-E have another device (NATE) on board that measures the same wind component as MESA. Our limited comparisons of these measurements show that they are in reasonable agreement. We suggest that a substantial amount of MESA wind data from these two satellites

be processed in order to make a careful comparison with the NATE. On AE-C NATE does not measure the horizontal wind component, and we suggest that the MESA wind data for this satellite be processed in its entirety (for the elliptic orbit phase) and be placed in the UA file. Fortunately, the AE-C MESA data are the cleanest of all. Author (GRA)

N81-24691# Texas Univ. at El Paso. Dept. of Electrical Engineering.

EXTENDED APPLICABILITY OF OPTICAL WIND SENSING TECHNIQUES Final Report, 1 Jul. 1979 - 31 Aug. 1980

Jack Smith Feb. 1981 55 p refs
(Grant DAAG29-79-G-0072)
(AD-A098021; ERADCOM/ASL-CR-81-0072-1; ARO-16654.1-GS) Avail: NTIS HC A04/MF A01 CSCL 17/8

The objectives of this study were to extend the applicability of optical crosswind sensing techniques to allow operation in rain and to determine the feasibility of using the techniques to study water vapor induced fluctuations at millimeter wavelengths. Two field tests were conducted to determine the effects of rain on optical crosswind sensors. The results showed that, (a) temporal filtering of the rain induced noise could improve the optical sensor performance under light rain conditions, (b) a simple frequency measurement of the fluctuating signal yielded a good representation of the windspeed variations, and (c) an improved turbulent signal to rain signal ratio can be obtained by using a receiver array to form a spatial filter Temporal filtering imposes an upper limit on the speed which can be measured, but spatial filters would not have this limitation. Wavelength scaling of intensity fluctuation observed at optical frequencies and at millimeter wave frequencies is used to obtain estimates of temperature and water vapor induced scintillations at millimeter and submillimeter wavelengths in the propagation windows. The estimated values are on the order of those observed in a 35 GHz propagation experiment. GRA

N81-24692# Alaska Univ., Anchorage. Arctic Information and Data Center.

WIND ENERGY RESOURCE ATLAS. VOLUME 10: ALASKA REGION

J. L. Wise, T. Wentink, Jr., R. Becker, Jr., A. L. Comiskey, D. L. Elliott (Pacific Northwest Lab.), W. R. Barchet (Pacific Northwest Lab.), and R. L. George (Pacific Northwest Lab.) Dec. 1980 181 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3195-WERA-10) Avail: NTIS HC A09/MF A01

Background is presented on how the wind resource is assessed and on how the results of the assessment should be interpreted. A description of the wind resource on a state scale is given. The results of the wind energy assessments for each subregion are assembled into an overview and summary of the various features of the Alaska wind energy resource. An outline to the descriptions of the wind resource given for each subregion is included. The subregion wind energy resources are described in greater detail than is the Alaska wind energy resource, and features of selected stations are discussed. DOE

N81-24693# Aspen Inst. for Humanistic Studies, Boulder, Colo.

ANTHROPOGENIC CLIMATE CHANGE: ASSESSING THE RESPONSIBILITY OF DEVELOPED AND DEVELOPING COUNTRIES

R. Schware and E. Friedman (Mitre Corp., McLean, Va.) 1980 8 p refs
(Contract DE-AC02-79EV-10281)
(DOE/EV-10281/2) Avail: NTIS HC A02/MF A01

If the international community of nations is ever to assess responsibility for carbon dioxide production and changed distribution of climate, calculations must be extended backward and forward to encompass a range of reasonable scenarios of fossil fuel use and carbon dioxide emissions. The preliminary calculations presented here indicate that developed countries might have to bear the brunt of responsibility for new climatic regimes, as suppliers of fuel to the world, as major consumers, and as the major overall cumulative contributions of CO2 to the atmosphere through the next century. DOE

N81-24694# National Center for Atmospheric Research, Boulder, Colo. Advanced Studies Program.

SCENARIO OF THE IMPACT OF A FUTURE CLIMATE CHANGE ON WORLD FOOD PRODUCTION

Robert Schware and William W. Kellogg 1980 16 p refs
(Contract DE-AC02-79EV-10281)
(DOE/EV-10281/7) Avail: NTIS HC A02/MF A01

In order to study implications of a future CO2-induced climatic change, plausible long-term changes of patterns of temperature and rainfall must be devised. One such scenario is presented, showing regions that may be wetter or drier than now in a future warmer climate. This information was combined with data on world food productivity to show some crops that could be affected by climate-induced changes in soil moisture are discussed. DOE

N81-24695# Environmental Research and Technology, Inc., Concord, Mass.

WIND ENERGY RESOURCE ATLAS. VOLUME 3: GREAT LAKES REGION

D. L. Paton, A. Bass, D. G. Smith, D. L. Elliott (Battelle Pacific Northwest Lab., Richland, Wash.), W. R. Barchet (Battelle Pacific Northwest Lab., Richland, Wash.), and R. L. George (Battelle Pacific Northwest Lab., Richland, Wash.) Feb. 1981 187 p refs Prepared for Battelle Pacific Northwest Lab.
(Contract DE-AC06-76RL-01830)
(PNL-3195-WERA-3-Vol-3) Avail: NTIS HC A09/MF A01

The Great Lakes Region atlas assimilates six collections of wind resources data, one for the region and one for each of the five states that compose the Great Lakes region: Illinois, Indiana, Michigan, Ohio, Wisconsin. At the state level, features of the climate, topography, and wind resource are discussed in greater detail than in the regional discussion and the data locations on which the assessment is based are mapped. Variations over several time scales in the wind resource at selected stations in each state are shown on graphs of monthly average and interannual wind speed and power, and of hourly average wind speed for each season. Other graphs present speed, direction, and duration frequencies of the wind at these locations. DOE

N81-24696# Battelle Pacific Northwest Labs., Richland, Wash.

WIND RESOURCE ASSESSMENT IN THE NORTHWEST UNITED STATES

W. R. Barchet Aug. 1980 3 p refs Presented at the Natl. Conf. on Renewable Energy Technol., Honolulu, Hawaii, 7 Dec. 1980
(Contract DE-AC06-76RL-01830)
(PNL-SA-8875; CONF-801203-6) Avail: NTIS HC A02/MF A01

The northwest United States includes three of the wind resource assessment regions delineated by the Pacific Northwest Laboratory (PNL): the Northwest region (Idaho, Montana, Oregon, Washington, and Wyoming), the Alaska region, and the Hawaii region (Hawaii and the Trust Territories of the Pacific). Detailed wind energy resource assessment atlases were prepared for each of these regions; the highlights are presented. DOE

N81-24697# Royal Netherlands Meteorological Inst., De Bilt.

PRECIPITATION DURING 1979

1980 126 p
(KNMI-117) Avail: NTIS HC A07/MF A01

Rain data gathered at precipitation stations across the Netherlands are reported. The situation of the stations is described, and details on measuring and recording are given. Data cover yearly amounts, amounts per day, per month, and per decade. Author (ESA)

N81-24698# Stockholm Univ. (Sweden). Dept. of Meteorology.

STRATIFORM CLOUDS AS A PROGNOSTIC VARIABLE IN A GLOBAL PREDICTION MODEL: RESULTS FROM A FIVE DAY FORECAST

Hilding Sundqvist Nov. 1980 50 p refs
(Contracts G-2923-100; G-UR-2923-102)
(DM-31) Avail: NTIS HC A03/MF A01

A parameterization scheme for stratiform condensation, including cloud water content as a prognostic variable was implemented in a global numerical prediction model. An

investigation of the model cloud behavior during a five day integration is carried out. The resulting clouds are grouped into three classes: low, middle and high, providing a good color picture. These pictures are compared with satellite pictures. Details of the model cloud water content and cover are shown. The results are realistic, however, further experiments which analyze the dynamical effects from the model clouds are recommended.
Author (ESA)

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N81-24699 Oregon State Univ., Corvallis.
ON THE DYNAMICS OF SUBINERTIAL CURRENTS OFF NORTHWEST AFRICA Ph.D. Thesis
Antoine Renaud Fabrice Badan-Dangon 1981 185 p
Avail: Univ. Microfilms Order No. 8109991

Measurements of current velocity and temperature made off Northwest Africa in early 1974 are used to investigate the dynamics of subinertial currents over the broad and shallow continental shelf. The local wind is the dominant driving mechanism for the currents over the shelf, which doesn't appear to be the case for the motions offshore. Most of the study was conducted at midshelf, 32 km from the coast and in 73 m of water depth. Turbulent bottom friction, estimated from the dominant alongshore currents, is found to be dynamically important and well correlated to the local wind. Because of this the structure of the water column is extremely time dependent; when the wind is strong both the surface and bottom Ekman layers become thick enough to merge into each other and dominate the entire water column. When the wind relaxes the Ekman layers thin down to about 10 m, allowing a presumably inviscid interior region to develop. Dissert. Abstr.

N81-24700 Louisiana State Univ. and A&M Coll., Baton Rouge.
DYNAMICS OF FLOW IN THE REGION OF THE TSUGARU STRAIT Ph.D. Thesis
Dennis Michael Conlon 1980 95 p
Avail: Univ. Microfilms Order No. 8110411

The dynamic interplay of the Tsushima Current and the Tsugaru Strait is explored in three regions: the inflow region (Sea of Japan side); the strait itself; and the outflow region (North Pacific side). Dynamic calculations and steric sea leveling in the inflow region indicate that transport into the Tsugaru Strait is principally governed by the geostrophically balanced Tsushima Current Setup generated south of the strait by the Tsushima Current cannot be maintained at the entrance to the strait; the resulting northward drop in coastal sea level is balanced by a net loss of transport into the strait. Within the strait, the flow is geostrophically balanced in the cross-stream direction. In the longstream direction, the barotropic pressure gradient is chiefly balanced by the longitudinal baroclinic pressure gradient and friction. Dissert. Abstr.

N81-24701 Rensselaer Polytechnic Inst., Troy, N. Y.
MATHEMATICAL ANALYSIS OF EFFECTS OF RANDOM OCEAN CURRENTS ON ACOUSTIC TRANSMISSION Ph.D. Thesis
Bruce Kent Newhall 1980 173 p
Avail: Univ. Microfilms Order No. 8109319

The effects of certain random ocean currents on acoustic transmissions in three ocean propagation channels are examined. First, the effects of a random current on the fluctuations of underwater continuous wave (CW) sound transmissions are considered for a horizontal isospeed channel. Next, the effects of random fluctuations in an ocean current on underwater CW sound transmission between a bottomed source and receiver are determined for an ocean channel with a linear, depth-dependent sound speed. Effects of such a current on ray geometry are determined and six basic current-induced ray states are found. Lastly, an analysis of a perturbed idealized cyclonic mesoscale eddy is performed. Included are random perturbations from perfectly circular streamlines and random perturbations in current magnitude. An approximation for ray travel times is developed in terms of the horizontally-averaged source-receiver current component, and travel-time statistics are investigated.
Dissert. Abstr.

N81-24702*# City Univ. of New York, N. Y.
THE EFFECT OF ZONAL GRADIENTS OF SEA SURFACE TEMPERATURE ON THE INDIAN OCEAN WINTER MONSOON
C. Cohen Jun. 1981 13 p refs
(Grant NGR-33-016-086)
(NASA-CR-164355) Avail: NTIS HC A02/MF A01 CSCL 08C

Several global climate simulations by the 7-layer, 8 x 10 GISS climate model were designed to test the contributions of various surface boundary conditions to the global climate. The model was run with the sun fixed at a perpetual January. In a comparison of run #5, in which realistic January surface boundary conditions were used, with run #4, which was the same except that a zonally symmetric climatological January sea surface temperature (SST) field was used, one of the results was that run #5 provided a better simulation of the Indian Ocean monsoon. A further comparison of the wind fields over the Indian Ocean that were generated by these two model runs is presented.
A.R.H.

N81-24703# Science Applications, Inc., McLean, Va.
SHEAR DATA DESCRIPTIONS Progress Report
R. B. Lambert and S. L. Patterson Aug. 1980 22 p refs
(Contract N00014-80-C-0393)
(AD-A098188; SAI-81-240-WA; RP-1) Avail: NTIS HC A02/MF A01 CSCL 08/3

Personnel from Science Applications, Inc. (SAI) and the Naval Research Laboratory (NRL) are working jointly on a description of shear in the upper ocean. SAI is focusing on vertical variability of vertical shear based on data obtained from free-fall velocity profilers. NRL is focusing on horizontal variability of both vertical and horizontal shear based on Lagrangian drifters. Another NRL data set resulting from simultaneous measurements with a Doppler sonar instrument and expendable current profilers will be described, but may not be processed in time for inclusion in this project. The purpose of this project is to assess the utility of combining the horizontal and vertical descriptions into a more comprehensive picture of upper ocean shear. Particular emphasis is to be placed on the distribution of Richardson number. The purpose of this progress report is to briefly describe the range of applicability of each data set and outline ways in which they may be related. Author (GRA)

N81-24704# National Oceanic and Atmospheric Administration, Seattle, Wash. Pacific Marine Environment Lab.
CIRCULATION IN THE STRAIT OF JUAN DE FUCA: RECENT OCEANOGRAPHIC OBSERVATIONS IN THE EASTERN BASIN
J. R. Holbrook, R. D. Muench, D. G. Kachel, and C. Wright Apr. 1980 48 p refs
(PB81-135352; NOAA-TR-ERL-412; PMEL-33;
NOAA-80120402) Avail: NTIS HC A03/MF A01 CSCL 08C

In two field experiments conducted in the eastern Strait of Juan de Fuca during winter 1977-78 and summer 1978, 3 month time series measurements of currents, over-the-water winds, shore winds, and water properties were obtained. From these data sets, the principal water motions are identified and described. Although local winds play a minor role in modifying near-surface circulation, coastal storms dramatically affect circulation in the eastern basin. GRA

N81-24705# National Oceanic and Atmospheric Administration, Washington, D. C. National Earth Satellite Service.
REPORT ON THE CONFERENCES ON THE NATIONAL OCEANIC SATELLITE SYSTEM
John W. Sherman, III Sep. 1980 139 p refs
(PB81-154957; NOAA-80123103) Avail: NTIS HC A07/MF A01 CSCL 08J

Approximately 400 persons participated in five conferences on the Potential National Oceanic Satellite System. The presentations and discussions at the conferences are documented and the initial analyses of the Conference Worksheets completed by 144 marine operational and research users are presented. The

report includes the points raised by these users and presents a series of findings and concerns. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N81-24706 Oklahoma Univ., Norman.
VENTRICULAR PERFORMANCE IN HEARTS OF RATS SUBJECTED TO PRESSURE OVERLOAD AND REPETITIVE EXERCISE Ph.D. Thesis
Eileen Mary Hasser 1980 166 p
Avail: Univ. Microfilms Order No. 8107518

The effects of preconditioning with repetitive exercise on the early and late responses to pressure overload due to abdominal aortic constriction (AC) in rats and the effects on ventricular function of exposure to repetitive exercise subsequent to the development of pressure induced cardiac hypertrophy were studied. All groups subjected to AC exhibited significantly elevated left ventricular pressure (LVP) compared to sham operated animals (SHAM). Ventricular contractile functional reserve capacity was unaffected by AC in either sedentary or exercised animals, similar inotropic responses to isoproterenol infusion and to total aortic occlusion were observed. Ventricular contractile functional reserve capacity was unaffected by AC or exercise at the five week time point. Heart pump functional reserve capacity was depressed in SED + AC(L) animals, but was normalized by exercise preconditioning. Exercise conditioning subsequent to the development of cardiac hypertrophy (AC + EX) reduced TPR and normalized CI and SI under control conditions. Ventricular contractile reserve capacity was unaltered in AC animals which remained sedentary or were exercised. It was suggested that the effects of exercise on ventricular performance was not due to alterations in biochemical properties of the myocardium.
E.A.K.

N81-24707 Texas Univ. Health Science Center, San Antonio.
THERMOREGULATORY AND ARTERIAL BAROREFLEX CONTROL OF HEART RATE IN THE HEAT-STRESSED BABOON Ph.D. Thesis
Andrew John Gorman, III 1981 191 p
Avail: Univ. Microfilms Order No. 8108428

The unanesthetized, chronically instrumented baboon was monitored to determine (1) the effect of a hyperthermia producing environmental heat stress on the reflex heart rate responses to changes in arterial blood pressure; (2) the relative importance of the sympathetic and parasympathetic nervous systems in effecting the elevation in heart rate during environmental heat stress; and (3) the autonomic control of heart rate during changes in arterial blood pressure in the normothermic and hyperthermic states. It is concluded that in the heat-stressed baboon: (1) no significant interaction exists between the thermoregulatory and baroreflex control of heart rate; (2) a change in the autonomic balance to the heart during heat stress occurs which is responsible along with local mechanisms for producting the rise in heart rate; and (3) the autonomic mediation of the reflex tachycardia during hypotensive stimuli is altered during hyperthermia.
Dissert. Abstr.

N81-24708# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
ENZYMATIC DETERMINATION OF OXYGEN IN AQUEOUS SOLUTIONS. 1: PHOTOSYNTHESIS RATE IN CULTIVAR OF CICHORIUM ENDIVIA L
F. Restaino, S. Scaramucci, G. Interlandi, and A. Marchesini 1981 13 p refs Transl. into ENGLISH from Atti Della Soc. Ital. di Sci. Nat. e del Museo Civico di Storia Nat. di Milano (Italy), 120 (1/2), 1979 p 132-140 Prepared for National Research Council of Canada
(ISSN-0077-5606; NRC/CNR-TT-1991) Avail: NTIS HC A02/MF A01

A method based on the enzymatic stoichiometric reduction of oxygen and on the oxidation of ascorbic acid was applied to determine the quantity of oxygen in aqueous solutions. This reaction is oxygen-dependent and under anaerobic conditions the 2,6 dichloroindophenol oxidizes the excess ascorbic acid. The initial oxygen content of the solution is determined from the difference between the total ascorbic acid and the residual ascorbic acid. This method was used for titration of oxygen produced by leaves of Cichorium endivia l. immersed in carbonated water and exposed to sunlight. The results indicate that some strains of Cichorium exhibit a higher photosynthetic rate than the others. Field tests should confirm whether the increased quantity of oxygen, produced by photosynthetic activity under the same conditions existing during the experimentation, corresponds to an increased net production of organic matter. M.G.

N81-24709# Ohio State Univ., Columbus. Dept. of Civil Engineering.
FULL SCALE FIELD DEMONSTRATION OF UNHEATED ANAEROBIC CONTACT STABILIZATION Quarterly Status Report, Jul. - Sep. 1980
Robert M. Sykes Nov. 1980 13 p
(Contract DE-AC02-80CS-24310)
(DOE/CS-24310/2) Avail: NTIS HC A02/MF A01

Gas production data is included. At present, the experimental digester (not heat added) is operating at an SRT of about 17 days and a temperature of 78 F and is performing about the same as the control units operating at an SRT of 10 days and a temperature of 94 F. DOE

N81-24710# California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.
METABOLISM OF FATTY ACIDS IN RAT BRAIN IN MICROSOMAL MEMBRANES
E. E. Aeberhard, Minerva Gan-Elepano, and James F. Mead 1980 32 p refs
(Contracts DE-AC03-76SF-00012; DE-AM03-76SF-00012; Grant NIH GM-19177)
(UCLA-12-1289) Avail: NTIS HC A02/MF A01

Using a technique in which substrate fatty acids are incorporated into microsomal membranes followed by comparison of their rates of desaturation or elongation with those of exogenous added fatty acids it was found that the desaturation rate is more rapid for the membrane bound substrate than for the added fatty acid. Moreover, the product of the membrane bound substrate is incorporated into membrane phospholipid whereas the product of the exogenous substrate is found in di and triacyl glycerols and in free fatty acids as well. These and other findings point to a normal sequence of reaction of membrane liquids with membrane bound substrates involving transfer of fatty acid from phospholipid to the coupled enzyme systems without ready equilibration with the free fatty acid pool. DOE

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N81-24711* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
URINE COLLECTION DEVICE Patent
Roger B. Michaud, inventor (to NASA) (Martin Marietta Corp., Denver) Issued 27 Jan. 1981 11 p Filed 30 May 1978 Sponsored by NASA
(NASA-Case-MSC-16433-1; US-Patent-4,246,901; US-Patent-Appl-SN-910992; US-Patent-Class-128-295; US-Patent-Class-4-144.3; US-Patent-Class-128-761) Avail: US Patent and Trademark Office CSCL 06B

A urine collection device for females is described. It is comprised of a collection element defining a urine collection chamber and an inlet opening into the chamber and is adapted to be disposed in surrounding relation to the urethral opening of the user. A drainage conduit is connected to the collection element in communication with the chamber whereby the chamber and conduit together comprise a urine flow pathway for carrying urine generally away from the inlet. A first body of wicking material is mounted adjacent the collection element and extends at least partially into the flow pathway. The device preferably also comprise a vaginal insert element including a seal portion for preventing the entry of urine into the vagina.
Official Gazette of the U.S. Patent and Trademark Office

N81-24712* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 219
May 1981 51 p
(NASA-SP-7011(219)) Avail: NTIS HC $7.00 CSCL 06E

This bibliography lists 118 reports, articles, and other documents introduced into the NASA scientific and technical information system in April 1981. Author

N81-24713 Illinois Univ. at Urbana-Champaign.
KINEMATIC MODELLING AND OSTEOMETRIC SCALING OF ANATOMICAL JOINTS AND SKELETAL SYSTEMS Ph.D. Thesis
Henry Joseph Sommer, III 1980 104 p
Avail: Univ. Microfilms Order No. 8108669

Three techniques proposed calibration of instrumented spatial linkages, kinematic modeling of anatomical joints, and osteometric scaling are jointly directed at one of the most prevalent and frustrating, yet basic, problems in musculo-skeletal biomechanics today-the almost total lack of readily available geometric and kinematic models. Singly, each technique may stand alone or may be used in conjunction with other biomechanical or antropometric analyses. Instrumented spatial linkages (ISL's) are finding wide applications in biomechanics for measuring all six degrees of freedom of relative motion between anatomical bodies and for point coordinate digitization. Numerical calibration of the kinematic and electrical parameters describing an ISL can produce superior accuracy for such biomechanical measurements and can statistically estimate this accuracy. Dissert. Abstr.

N81-24714 Utah Univ., Salt Lake City.
MEDICAL APPLICATIONS OF ION SENSITIVE FIELD EFFECT TRANSISTORS Ph.D. Thesis
Bruce Alan McKinley 1980 85 p
Avail: Univ. Microfilms Order No. 8111290

Three studies of the use of ion sensitive field effect transistors (ISFET) are reported. The first study demonstrates in vivo use of prototype K + ISFET probes in several potential clinical applications simulated in animals. The second study involves the use of Ca ++ ISFET probes to monitor Ca++ activity in blood of dogs during simulated infusion of citrated blood. The third study involves simultaneous continuous monitoring of K+ activity in the interstitial fluid space and in circulating blood during induction of and recovery from hemorrhagic shock in dogs. Results of these studies demonstrate feasibility of using ISFET probes for biomedical monitoring purposes and, in addition, outline specific areas for application of ISFET sensors. These areas include: (1) intravascular continuous monitoring of blood in regions of the physiologic system of interest; (2) tissue monitoring to detect (local) metabolic changes at the cellular level; (3) simultaneous multiple fluid compartment monitoring to assess mass transfer rates in response to therapeutic procedures or disturbance of the physiologic system. Dissert. Abstr.

N81-24715# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
SIGNIFICANCE OF CIRCADIAN RHYTHMS IN AEROSPACE OPERATIONS
Karl E. Klein (DFVLR, Bad Godesberg, West Germany) and Hans M. Wegmann Dec. 1980 64 p refs
(AGARD-AG-247; ISBN-92-835-1378-9) Avail: NTIS HC A04/MF A01

Reviewing experimental research and results from the pertinent literature, the significance of circadian rhythms is discussed under the following aspects: characteristics and interrelationships of environmental and biological circadian systems; circadian rhythms of mental and physical performance, as well as of susceptibility and resistance; modification of circadian cycling through external and internal factors; disturbance of circadian rhythmicity and sleep-wake cycling in air and space operations and shiftwork; consequences for performance efficiency and health; formulas; models and rest duty regulations; and recommendations for the passenger, crew, and management. The Biorhythm Theory is critically reviewed. T.M.

N81-24716*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APPARATUS FOR DETERMINING CHANGES IN LIMB VOLUME Patent Application
P. K. Bhagat (Kentucky Univ., Lexington) and V. C. Wu, inventors (to NASA) (Kentucky Univ., Lexington) Filed 10 Feb. 1981 14 p Sponsored by NASA
(NASA-Case-MSC-18759-1; US-Patent-Appl-SN-233270) Avail: NTIS HC A02/MF A01 CSCL 06B

A measuring apparatus for determining changes in the volume of limbs or other body extremities by determining the cross-sectional area of such limbs is described. It is comprised of a transmitter including first and second transducers and a receiver for positioning on the surface of the limb. The distances between the receiver crystal and the first and second transducers are represented by respective first and second chords (d sub 1 d sub 2) of the cross-section of the limb and the predetermined distance between the first and second transducers is represented by a third chord (d sub 3). The measuring apparatus also includes a Pinger and associated electrical circuitry for generating acoustic pulses at the transducers. The travel time of the acoustic pulses along the D sub 1, D sub 2 chords is derived. A computer is connected to the receiver for computing the area of the limb cross-section utilizing these signals. NASA

N81-24717*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
BIOMEDICAL FLOW SENSOR Patent Application
H. Eugene Winkler, inventor (to NASA) Filed 16 Apr. 1981 14 p
(NASA-Case-MSC-18761-1; US-Patent-Appl-SN-254688) Avail: NTIS HC A02/MF A01 CSCL 06B

A biomedical flow sensor for intravenous systems is described. The device includes a packagable unit of a bottle, tubing and hypodermic needle which can be pre-sterilized and is disposable. The tubing has spaced tubular metal segments. The temperature of the metal segments and the fluid flow is sensed by thermistors and at a downstream location heat is input by a resistor to the metal segment by control electronics. The fluid flow and the electrical power required of the resistor to maintain a constant temperature differential between the tubular metal segments is a measurable function of fluid flow through the tubing. The differential temperature measurement is made in control electronics and also can be used to control a flow control valve or pump on the tubing to maintain a constant flow in the tubing and to shut off the tubing when air is present. NASA

N81-24718# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Industrial Engineering and Operations Research.
AN EXPERIMENTAL DETERMINATION OF THE EFFECT OF IMAGE QUALITY ON EYE MOVEMENT AND SEARCH FOR STATIC AND DYNAMIC TARGETS Technical Report, 9 Nov. 1975 - 6 Nov. 1977
James C. Gutmann, Harry L. Snyder, Willard W. Farley, and John E. Evans, III Wright-Patterson AFB, Ohio AMRL Aug. 1979 93 p refs
(Contract F33615-76-C-5022)
(AD-A077728; AMRL-TR-79-51) Avail: NTIS HC A05/MF A01 CSCL 06/16

The results of two experiments which investigated the effect of the quality of a televised image on eye movements and search related dependent measures are reported. The first experiment search task involved having subjects perform an air to ground search during a simulated flight. The quality of the image presented was varied by either passing, low pass filtering, or attenuating the video signal and by adding electrical white noise to the video signal. The search task of the second experiment consisted of having the subjects search for a designated letter or numeral across a televised picture of randomly positioned letters and numerals. The quality of the picture was varied by either passing, low pas filtering, high pass filtering, or attenuating the video signal and by adding electrical white noise to the video signal. R.C.T.

N81-24719# California Univ., Irvine. Dept. of Community and Environmental Medicine.
TOXIC HAZARDS RESEARCH UNIT Annual Technical Report, Jun. 1979 - May 1980
J. D. MacEwen and E. H. Vernot Aug. 1980 137 p refs

Sponsored in part by the Navy and DOT
(Contract F33615-76-C-5005)
(AD-A091617; AFAMRL-TR-80-79; AR-17) Avail: NTIS HC A07/MF A01 CSCL 06/20

Chronic toxicity or oncogenic studies were carried out with methylcyclohexane, tricyclodecane, purified 1,1-dimethylhydrazine, and bicycloheptadiene. A subchronic inhalation study was conducted with shale derived JP-5 and DFM fuels. Acute toxicity studies were conducted on a variety of chemical agents used by the Air Force and Navy. T.M.

N81-24720*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF CIRCADIAN RHYTHM PHASE ALTERATION ON PHYSIOLOGICAL AND PSYCHOLOGICAL VARIABLES: IMPLICATIONS TO PILOT PERFORMANCE (INCLUDING A PARTIALLY ANNOTATED BIBLIOGRAPHY)
Daniel C. Holley, Charles M. Winger, Charles W. DeRoshia, Michele P. Heinold, Dale M. Edgar, Norman E. Kinney, Susan E. Langston, Carol L. Markley, and Jill A. Anthony Mar. 1981 537 p Prepared in cooperation with San Jose State Univ., Calif.
(NASA-TM-81277; A-8515) Avail: NTIS HC A23/MF A01 CSCL 06P

The effects of environmental synchronizers upon circadian rhythmic stability in man and the deleterious alterations in performance and which result from changes in this stability are points of interest in a review of selected literature published between 1972 and 1980. A total of 2,084 references relevant to pilot performance and circadian phase alteration are cited and arranged in the following categories: (1) human performance, with focus on the effects of sleep loss or disturbance and fatigue; (2) phase shift in which ground based light/dark alteration and transmeridian flight studies are discussed; (3) shiftwork; (4) internal desynchronization which includes the effect of evironmental factors on rhythmic stability, and of rhythm disturbances on sleep and psychopathology; (5) chronotherapy, the application of methods to ameliorate desynchronization symptomatology; and (6) biorythm theory, in which the birthdate based biorythm method for predicting aircraft accident susceptability is critically analyzed. Annotations are provided for most citations. A.R.H.

N81-24721*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A 14-DAY GROUND-BASED HYPOKINESIA STUDY IN NONHUMAN PRIMATES: A COMPILATION OF RESULTS
L. Kazarian (Wright-Patterson AFB, Ohio), C. Cann (California Univ.), M. Parfitt (Henry Ford Hospital), D. Simmons (Washington Univ.), and E. Morey-Holton Apr. 1981 62 p refs
(NASA-TM-81268; A-8488) Avail: NTIS HC A04/MF A01 CSCL 06S

A 14 day ground based hypokinesia study with rhesus monkeys was conducted to determine if a spaceflight of similar duration might affect bone remodeling and calcium homeostatis. The monkeys were placed in total body casts and sacrificed either immediately upon decasting or 14 days after decasting. Changes in vertebral strength were noted and further deterioration of bone strength continued during the recovery phase. Resorption in the vertebrae increased dramatically while formation decreased. Cortical bone formation was impaired in the long bones. The immobilized animals showed a progressive decrease in total serum calcium which rebounded upon remobilization. Most mandibular parameters remained unchanged during casting except for retardation of osteon birth or maturation rate and density distribution of matrix and mineral moieties. Author

N81-24722# Defence Research Establishment, Ottawa. (Ontario). Radiation Biology Section.
TECHNIQUES FOR CALIBRATING MINIATURE ELECTRIC-FIELD PROBES FOR USE IN MICROWAVE BIOEFFECTS STUDIES AT 2450 MHz: EVALUATION AND CALIBRATION OF BRH - NARDA PROBES
Douglas A. Hill and George W. Hartsgrove Oct. 1980 44 p refs
(AD-A097764; DREO-TN-80-31) Avail: NTIS HC A03/MF A01 CSCL 06/18

A set of miniature probes for determining electric fields in tissue was evaluated and calibrated for use in microwave bioeffects studies at 2450 MHz. The calibrations in air and tissue-equivalent liquids were carried out using a new S-band waveguide technique. The air calibration using waveguide has an accuracy of + or - 10% compared to + or - 18% for our anechoic-chamber calibration. The average probe sensitivity in air is 1.0 mV/mW per sq cm for the five probes calibrated and varies slightly with power density and probe. To estimate probe sensitivity in tissue, a section of waveguide is filled with a tissue-equivalent liquid and is separated from the air-filled waveguide by a very thin (0.25 mm) planar spacer. The probe response is measured as a function of position on either side of the spacer and extrapolated to the interface. The ratio of probe sensitivity in air to that in test liquid is then determined using the continuity of tangential E field across the spacer. Liquids with dielectric properties simulating both wet and dry tissues were used. For the water-glycerol solution modelling wet tissue the probes are 3.0 + or - 0.6 times more sensitive to E superscript 2 than for air. When used in tissue the total calibration error is estimated to be + or - 30% for E superscript 2 and + or - 40% for the specific absorption rate at the site. One of the problems with this probe design, the mechanical weakness near the tip, has been eliminated in newer designs. The other problem, that the size of the probe tip (approximately 3 mm) is too large for optimal use in small-animal organs, is more difficult to solve. GRA

N81-24723# Lovelace Biomedical and Environmental Research Inst., Albuquerque, N. Mex. Inhalation Toxicology Research Inst.
LOW-Btu-GASIFIER EMISSIONS TOXICOLOGY Status Report, Jun. 1980
George J. Newton, ed. Sep. 1980 36 p refs
(Contract DE-AC04-76EV-01013)
(LMF-77) Avail: NTIS HC A03/MF A01

The experimental low Btu gasifier at METC was sampled to determine aerosol components in gaseous process streams and to assess potential toxicants in liquid and solid effluent streams with the most recent sampling effort in December 1979. Diluting and/or cooling low Btu producer gas, as would happen in fugitive releases, produces a dense, respirable aerosol. Toxic element concentrations are higher in aerosols from clean gas than from raw gas streams at METC. Gasifier operating conditions have little effect on the elemental composition of cleaned gas aerosols. DOE

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

No abstracts in this category.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N81-24724* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SYSTEM FOR STERILIZING OBJECTS Patent
Coleman J. Bryan, Edward E. Wright, Jr., and Clyde V. Moyers, inventors (to NASA) Issued 10 Feb. 1981 4 p Filed 8 Jun. 1979 Supersedes N79-33848 (17 - 24, p 3263)
(NASA-Case-KSC-11085-1; US-Patent-4,250,143; US-Patent-Appl-SN-046739; US-Patent-Class-422-109; US-Patent-Class-422-3; US-Patent-Class-422-27; US-Patent-Class-422-30; US-Patent-Class-422-34; US-Patent-Class-261-79A) Avail: US Patent and Trademark Office CSCL 06K

A system for producing a stream of humidified sterilizing

gas for sterilizing objects such as the water systems of space vehicles and the like includes a source of sterilant gas which is fed to a mixing chamber which has inlet and outlet ports. The level of the water only partially fills the mixing chamber so as to provide an empty space adjacent the top of the chamber. A heater is provided for heating the water in the chamber so as to produce a humidified atmosphere. The sterilant gas is fed through an arcuate shaped tubular member connected to the inlet port of the mixing chamber for producing a vortex type of flow of sterilant gas into the chamber for humidifcation. A tubular member extends from the mixing chamber for supplying the humidified sterilant gas to the object for being sterilized. Scrubbers are provided for removing the sterilant gas after use.

Official Gazette of the U.S. Patent and Trademark Office

N81-24725*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AUTOMATION IN ORGANIZATIONS: ETERNAL CONFLICT

Duncan L. Dieterly May 1981 40 p refs Prepared in cooperation with Air Force Human Resources Lab., Moffett Field, Calif.

(NASA-TM-81290; A-8574; AFHRL-H-81-808) Avail: NTIS HC A03/MF A01 CSCL 05H

Some ideas on and insights into the problems associated with automation in organizations are presented with emphasis on the concept of automation, its relationship to the individual, and its impact on system performance. An analogy is drawn, based on an American folk hero, to emphasize the extent of the problems encountered when dealing with automation within an organization. A model is proposed to focus attention on a set of appropriate dimensions. The function allocation process becomes a prominent aspect of the model. The current state of automation research is mentioned in relation to the ideas introduced. Proposed directions for an improved understanding of automation's effect on the individual's efficiency are discussed. The importance of understanding the individual's perception of the system in terms of the degree of automation is highlighted.

A.R.H.

N81-24726# Dayton Univ., Ohio.

USER'S GUIDE FOR COMBIMAN (COMPUTERIZED BIOMECHANICAL MAN-MODEL), VERSION 4 Technical Interim Report

P. Bapu, Susan Evans, P. Kikta, M. Korna, and Joe W. McDaniel (AMRL) Wright-Patterson AFB, Ohio AMRL Jan. 1981 293 p refs Supersedes AMRL-TR-78-31

(Contract F33615-78-C-00507; AF Proj. 7184)

(AD-A097705; UDR-TR-80-44; AFAMRL-TR-80-91; AMRL-TR-78-31) Avail: NTIS HC A13/MF A01 CSCL 05/8

This User's Guide describes the operational procedures for using the COMBIMAN (COMputerized Biomechanical MAN-Model) programs. The Guide includes an introduction to the man-model and the conventions used to develop and analyze crew stations. It also deals with the operation of the programs which make up the COMBIMAN system. These programs include the interactive graphics program CBM04, and the three key file creation/modification programs, CBMAM, CBMCM, and CBMVM, which maintains the Data Bases of anthropometric surveys, crew station configurations, and visibility contour definitions respectively. It also contains a complete description of the use of CBMOFF, the off-line plot program. The guide to the operation of the four main programs includes descriptions of the processing available with each program, definitions and examples of all input and output data formats used, procedures to follow to load the programs and specify processing for each, and explanations of all diagnostic messages generated by the programs. GRA

N81-24727# California Univ., Los Angeles. Dept. of Physiology and Biophysics.

DIETARY PROTECTION AGAINST PULMONARY OXYGEN POISONING Final Technical Report, 1 Apr. 1974 - 31 Dec. 1980

Christopher L. Schatte and Melvin M. Mathias 31 Dec. 1980 73 p refs

(Contract N00014-76-C-0437)

(AD-A097750) Avail: NTIS HC A04/MF A01 CSCL 06/2

This project was designed to determine any influence of dietary composition on susceptibility to pulmonary oxygen toxicity in rats and mice. Of a variety of vitamins given in supranormal doses, only vitamin E proved efficacious in delaying the onset of toxic symptoms in rats exposed to pure oxygen at one atmosphere absolute. Dietary supplementation with the trace element selenium appeared to be beneficial in some experiments but not others. Alteration of amount and type of dietary fat influenced mortality of rats at 1ATA oxygen. The mechanism by which polyunsaturated fats in the diet might change susceptibility to oxygen toxicity was not elucidated, but a possible relationship with pulmonary prostaglandin metabolism is suggested. GRA

N81-24728# Illinois Univ. at Urbana. Dept. of Psychology.

THE PROCESSING DEMANDS OF HIGHER ORDER MANUAL CONTROL: APPLICATION OF ADDITIVE FACTORS METHODOLOGY

Christopher D. Wickens and William Derrick Mar. 1981 46 p refs

(Contract N00014-79-C-0658; NR Proj. 196-158)

(AD-A098077; EPL-81-1/ONR-81-1) Avail: NTIS HC A03/MF A01 CSCL 05/1

This investigation examines the locus of processing demands of 2nd order manual control, and of tracking a high bandwidth signal, within the framework of multiple resource theory. It is hypothesized that 2nd order tracking may impose greater demands upon perceptual encoding (processing higher error derivatives), central processing (updating a more complex internal model) or response (executing impulse response functions). To assess the locus of demands, in experiment 1, eight subjects performed a Sterberg Memory Search task by itself, and concurrently with a first and a second order compensatory tracking task. Following the procedures outlined by Micalizzi Wickens (1980, Tech. Report EPL-80-2/ONR-80-2), Sternberg variables of perceptual load, central processing load and response load were each systematically manipulated. All three variables were found to produce underradiative effects with the presence or absence of 1st order tracking. That is, their effect was attenuated in the presence of the tracking task. However, the manipulations of perceptual and central processing load were enhanced by 2nd order, as opposed to 1st order tracking, while the manipulation of response load was not. Thus our analyses indicated that the effects of higher order manual control were localized in the perceptual and central processing stages. GRA

N81-24729# Defence Research Establishment, Ottawa. (Ontario). Protective Science Div.

CALCULATIONS OF HEAT AND VAPOUR TRANSPORT IN CLOTHING: TRANSIENT EFFECTS IN HYGROSCOPIC MATERIALS

Brian Farnworth Oct. 1980 29 p refs

(AD-A098004; DREO-TN-80-25) Avail: NTIS HC A03/MF A01 CSCL 15/5

A numerical model of heat and water vapor transport through multilayered clothing systems under transient conditions is presented. Taken into account are the condensation and evaporation of liquid water within the clothing layers and changes in the amount of water absorbed by hygroscopic fibers although the hygroscopic properties are taken to be a very simple form. The calculations are compared to experiments reported by Woodcock in 1962, giving good agreement, and used to discuss the so called buffering effect of hygroscopic clothing materials.

GRA

N81-24730# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

MALE AND FEMALE STRENGTH CAPABILITIES FOR OPERATING AIRCRAFT CONTROLS

Joe W. McDaniel Mar. 1981 6 p refs

(AD-A098256; AFAMRL-TR-81-39) Avail: NTIS HC A02/MF A01 CSCL 05/5

There has long been concern that the resistance of some aircraft controls is too large. Now that the Air Force has both male and female pilots, this concern is greater. The workload and Ergonomics Branch of AFAMRL has just completed a study of the physical strength and endurance capabilities of 61 male and 61 female subjects in a stick-controlled aircraft simulator. Additionally, 110 of these subjects completed a nine-week exercise training program to strengthen muscles used on aircraft controls. Results show weak males and weak females have similar leg

strength. The arm strength of strong females was similar to that of weak males; however, physical training improved leg strength more than arm strength. Males and females had similar increases in strength due to physical training. Most of the females and some males fell below the resistance specification for current aircraft. Author (GRA)

N81-24731# Centre Technique des Industries Mecaniques, St. Etienne (France).
COMPILATION OF A CATALOG OF MANIPULATOR ARMS AND INDUSTRIAL ROBOTS Final Report [CONSTITUTION D'UNE DOCUMENTATION RELATIVE AUX BRAS MANIPULATEURS ET ROBOTS INDUSTRIELS]
J. P. Devimeux Dec. 1979 139 p In FRENCH
(CETIM-1-4N-02-0-X) Avail: NTIS HC A07/MF A01

A catalog of mechanical devices which are commercially available for the automation of a wide variety of industrial jobs, is presented. Robotics, the classification of these machines, and functional characteristics of manipulators and industrial robots are considered. Machine learning, (command) and control, is treated. Industrial applications of automation are surveyed. The literature on each machine listed is reviewed, and a machine data sheet for each device are also included. Author (ESA)

N81-24732# Rhode Island Univ., Kingston. Dept. of Electrical Engineering.
GENERAL METHODS TO ENABLE ROBOTS WITH VISION TO ACQUIRE, ORIENT AND TRANSPORT WORKPIECES
J. Birk, R. Kelley, T. Barron, J. Crouch, D. Duncan, J. Hall, F. Kolanko, A. Mak, H. Martins, and R. Mehta Aug. 1980 196 p refs
(Grant NSF DAR-78-27337)
(PB81-148934; NSF/RA-800334; Rept-6) Avail: NTIS HC A09/MF A01 CSCL 13I

These methods are intended to enhance the range of industrial applications to which robots can be applied. The problem of feeding workpieces that are unoriented in bins was adopted as the focus of research because it is a generic problem in manufacturing industries. The following aspects of this project are discussed: a robot system which can acquire a class of workpieces from a bin and pose them at a goalsite; a robot system which can acquire cylindrical workpieces from a bin; design of a special electronic processor for extracting features based on local gradient direction histograms; and guidelines for the design of robot hands for handling parts that are not preoriented. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

N81-24733 Illinois Univ. at Urbana-Champaign.
A MONTE CARLO STUDY: ROBUSTNESS OF ANALYSIS OF COVARIANCE TO VIOLATION OF SELECTED ASSUMPTIONS Ph.D. Thesis
David Samuel Thomson 1980 148 p
Avail: Univ. Microfilms Order No. 8108688

A Monte Carlo simulation was used to investigate the robustness of the analysis of covariance (ANCOVA) model relative to violations of some of the model's assumptions and to various experimental conditions. The effect of violating the following assumptions was examined: (1) homogeneity of within-cell population regression coefficients (i.e., slopes); and (2) homogeneity of within-cell population error variances. In addition, the effect of having a contaminated sampling distribution from which the within-cell population error variances were generated (i.e., 10 or 20 percent of the sampling distribution has a proportionately larger variance) was examined as an experimental condition. In addition, analysis of variance was used to analyze the results of the Monte Carlo simulation with heterogeneous within-cell regression coefficients, and heterogeneous within-cell error variances for the two and three group cases. Dissert. Abstr.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering.*

N81-24734 Stanford Univ., Calif.
NUMBER THEORETIC PROCESSORS Ph.D. Thesis
Alan Huang 1981 149 p
Avail: Univ. Microfilms Order No. 8108949

The architecture of number theoretic processors emphasizes modularity in arithmetic accuracy and latency. This modularity facilitates the use of parallelism and pipelining and results in a processor which is fabricated from a cellular array of read only memories (ROMs). This modularity offers opportunity to automatically synthesize, fabricate, and test processors of arbitrary complexity. The key to this modularity is the use of a residue number system. This number system does not require a carry, and as a consequence, the arithmetic can be performed in parallel with table lookup and in same amount of time. Techniques are disclosed for decomposing the domain-to-range mapping of a computational function into a network of simpler mappings; such that each of the simpler mappings need never communicate with other than their next level neighbors. Dissert. Abstr.

N81-24735 Georgia Inst. of Tech., Atlanta.
OPERATIONAL SURVIVABILITY IN GRACEFULLY DEGRADING DISTRIBUTED PROCESSING SYSTEMS Ph.D. Thesis
Edith Waisbrot Martin 1980 166 p
Avail: Univ. Microfilms Order No. 8107287

A 2k-p Fractional Factorial experiment was conducted using the simulator as an experimental tool. One hundred and twenty-eight experimental cases were run in which 11 different factors were manipulated and 46 derived measures monitored. The results of the 128 experiment runs and the subsequent 300,000 subcases were examined using a number of statistical techniques. Several approaches to regression modeling such as stepwise and all possible subset regression were used to build explanatory models from the results collected. Ten of these models proved to serve well in an explanatory capacity, consequently, data splitting was employed to assess the value of these models when used as predictors. It was determined that three models which function well in an explanatory role also serve well in predicting survivability and performance. The concept of operational survivability and performance as proposed can be expressed quantitatively. Dissert. Abstr.

N81-24736 Case Western Reserve Univ., Cleveland, Ohio.
THE OPTIMIZATION OF QUERIES IN RELATIONAL DATABASES Ph.D. Thesis
Robert Philip Kooi 1980 168 p
Avail: Univ. Microfilms Order No. 8109596

A fully implemented system for optimizing and executing queries for relational databases is described. The system optimizes n-table, equi-join queries written in QUEL, the query language supported by the INGRES relational database management system. Tenfold and greater improvements in response time to complex queries were achieved compared to INGRES. The system models query execution plans as binary trees where each node can be one of four operator types; join, restrict-project, reformat, and disk-resident-scan. The system also uses histograms to represent information about attribute's distributions. This information is used

to accurately determine query execution cost and results in queries which run approximately thirty percent faster than when the distributional information is not used (i.e., uniform distributions are assumed). Measurements are given comparing execution times for the system and INGRES comparing estimated and actual disk I/O with actual query execution time, and comparing the use of accurate distributional information stored in histograms with the use of uniform distributions. Dissert. Abstr.

N81-24737 Minnesota Univ., Minneapolis.
CONCURRENT UPDATE PROBLEM AND SYNCHRONIZATION IN DISTRIBUTED DATA BASE SYSTEMS Ph.D. Thesis
Saeed Khamene Rahimi 1980 291 p
Avail: Univ. Microfilms Order No. 8109499

Models formed by using queueing theoretic and simulation models are presented. The behaviors of the posted update algorithm (PAU), the distributed voting algorithm (DVA), and the centralized locking algorithm (CLA) are compared using these models. The comparison results indicate that the PUA algorithm is able to achieve more parallelism, preserve node autonomy, obviate global clocks, and consider the difference in the workloads at different nodes. The effects of various model parameters on the performance of the PUA, DVA, and CLA update algorithms are studied. These studies clearly show the importance of each parameter and that a realistic model must consider them. A study of the robustness of update algorithms PUA, DVA, and CLA is included as an attempt to identify different types of failures, their detection mechanisms, recovery mechanisms, and restart algorithms in distributed date base systems. Dissert. Abstr.

N81-24738 Illinois Univ. at Urbana-Champaign.
A VARIABLE PRECISION PROCESSOR MODULE Ph.D. Thesis
Catherine Yuk-Fun Chow 1980 189 p
Avail: Univ. Microfilms Order No. 8108466

One method of designing a variable precision processor module for the four basic floating point operations is presented. The variable precision module can be used serially by itself or in parallel with identical modules in a flexible manner. Both the precision of the operands and the number of processor modules can be varied without affecting the control of the modules or requiring extra programming effort. The mantissa of the operands are required to be in a signed digit representation that is neither maximally redundant nor minimally redundant. The general direction of mantissa processing is from the most significant end to the least significant end. For the majority of the allowed signed-digit representations, a three level digit slice for which a result digit depends on a maximum of three adjacent digit positions can be defined. A fourth adder level can be added for the rest of the allowed representations. Algorithms for the four basic floating point operations and three supporting functions are examined for both cases. The size of the digit set is found to affect the cost of the quotient digit selector as well as the complexity of the algorithms. Dissert. Abstr.

N81-24739 Utah Univ., Salt Lake City.
COG: AN ARCHITECTURAL-DESCRIPTION-DRIVEN COMPILER GENERATOR Ph.D. Thesis
Robert Russell Kessler 1981 129 p
Avail: Univ. Microfilms Order No. 8111301

The design and prototype implementation of an architectural description driven compiler generator, COG, is presented. COG is a major improvement over current systems in that: (1) the majority of the processing associated with code generation is performed when the compiler is created resulting in a smaller, faster code generator; (2) extensive use of a pattern matcher in all phases of the compiler adds to ease of use and enhanced understandability; (3) a practical technique for limiting the amount of searching for a target machine code sequence has been developed; (4) integral use of the target machine state aids in the generation of good local code; (5) the peephole optimizer is derived prior to the creation of the compiler and provides for pairwise optimization of instructions that are not necessarily adjacent. The COG system produces a cross compiler (a compiler that is implemented on one system and produces code for another system) from a syntactic and semantic description of the language and an architectural description of the target machine. Dissert. Abstr.

N81-24740 Stanford Univ., Calif.
AUTOMATIC PHYSICAL DESIGN OF LARGE WIRE-WRAP DIGITAL SYSTEMS Ph.D. Thesis
Lawrence Curtis Widdoes, Jr. 1981 177 p
Avail: Univ. Microfilms Order No. 8109105

A system is described which automatically performs the detailed physical design of a wire-wrap digital system, given a completed logical design, chip placement, and user specification of the particular component technology and wire-wrap package to be used. The system approximately optimizes measures of the manufacturability, reliability, and performance level of the physical design, as defined by parameters provided by the user. The system's models of the wire-wrap environment and component technologies are surveyed, and its major algorithms for physical design are discussed in detail. These models and algorithms are detailed enough to allow the complete high quality physical design of large, high performance central processing units. Furthermore, they are designed to be easily adapted by the user for specific design efforts. Dissert. Abstr.

N81-24741 Yale Univ., New Haven, Conn.
RETRIEVAL AND ORGANIZATIONAL STRATEGIES IN CONCEPTUAL MEMORY: A COMPUTER MODEL Ph.D. Thesis
Janet Lynne Kolodner 1980 409 p
Avail: Univ. Microfilms Order No. 8109797

The computerized Yale retrieval and updating system (CYRUS) stores and retrieves episodes in the lives of Secretaries of State Cyrus Vance and Edmund Muskie. When events are added to its memory, CYRUS integrates them into memory along with the events it already knows about and can then answer questions posed to it in English about the events it stores. The algorithms and memory organization used in CYRUS were developed by examining the way people answer questions requiring extensive memory search. It's reconstructive processes include instantiation strategies, which construct and elaborate on contexts for search, and search strategies, which direct construction. Dissert. Abstr.

N81-24742 Yale Univ., New Haven, Conn.
GENERALIZATION AND MEMORY IN AN INTEGRATED UNDERSTANDING SYSTEM Ph.D. Thesis
Michael Lebowitz 1980 468 p
Avail: Univ. Microfilms Order No. 8109800

An integrated system for language understanding, IPP (integrated partial parser), that encompasses the ability to generalize and record information in long-term memory as well as conceptual analysis is described. IPP is a program that learns about the world by reading stories taken from newspapers and the news wire, adding information from these stories to memory, and making generalizations that describe specific situations. It uses the generalizations that it has made to help in understanding future stories. As it reads stories, IPP adds them to its permanent memory. If it locates similar stories in memory as it does this, then it attempts to make generalizations that describe the similarities among the events. Such generalizations form the basis for organizing events in memory and understanding later stories. IPP also includes a procedure for confirming generalizations as further stories are read. In order to analyze the text that it reads, IPP makes extensive use of topdown, predictive processing. Dissert. Abstr.

N81-24743# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
A PASCAL SYSTEM FOR INTERDATA COMPUTERS
Jean Jobson, Hester vanRooyen, and Tim Jobson (Stellenbosch Univ.) May 1980 33 p refs
(CSIR-SWISK-15) Avail: NTIS HC A03/MF A01

The PASCAL 4A system is described which allows the user to compile and execute, on the 32-bit range of Interdata minicomputers, programs written in PASCAL P4. The system consists of a compiler, an assembler and an interpreter. Several features of the PASCAL language as implemented by the PASCAL 4A system are described, and the use of the system is explained. M.G.

N81-24744# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.

PERFORMANCE MODELS OF DISTRIBUTED DATABASE SYSTEMS Ph.D. Thesis

Victor On-Kwok Li Jan. 1981 178 p refs

(Contract N00014-77-C-0532)

(AD-A097771; LIDS-TH-1066) Avail: NTIS HC A09/MF A01 CSCL 09/2

A distributed database (DDB) consists of redundant copies of data files geographically distributed on a computer network. This thesis develops a performance model of a DDB. This model can be used to compare the performance (i.e., response time, utilization, etc.) of different concurrency control algorithms. We started by developing a network of queues model of a communication subnetwork. We have originally attempted to employ Jackson's Model but have concluded that Jackson's Model is inadequate for our purposes. The Independent Queues Model that we developed in this thesis make somewhat stronger assumptions than Jackson's Model, but has more flexibility and approximates better a real communication subnetwork. We found that in a general DDB, concurrency control algorithms could not be modelled accurately without taking into consideration the particular query processing strategy used. We have therefore developed two new query processing strategies: the MST and the MDT Algorithms. These two algorithms are easy to analyze and to implement. We next modelled the competition among different transactions in the DDB for the services of the database management system. Probabilistic arguments were used to determine the probability of conflicts between different database transactions and the delay due to conflicts. Author (GRA)

N81-24745# Maryland Univ., College Park. Dept. of Computer Science.

RESEARCH ON THE TRANSLATION AND STANDARDIZATION OF RELATIONAL AND NETWORK TYPE DATABASE MANAGEMENT SYSTEMS Final Report, 1 Sep. 1978 - 31 Jan. 1981

Michael L. Brodie Mar. 1981 10 p refs

(Grant DAAG29-78-G-0162)

(AD-A097766; ARO-15712.12-A-EL) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report contains a statement of the problems studied and the results and conclusions reached on the translation and standardization of relational and network type database management systems. Author (GRA)

N81-24746# Maryland Univ., College Park. Computer Vision Lab.

IMAGE SEGMENTATION BY TEXTURE USING PYRAMID NODE LINKING Interim Report

Matti Pietikainen and Azriel Rosenfeld Feb. 1981 27 p refs

(Grant AF-AFOSR-3271-77; AF Proj. 2304)

(AD-A098070; TR-1008; AFOSR-81-0366TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

In a 'pyramid' of successively reduced-resolution versions of an image, by linking nodes representing image blocks to nodes representing nearby larger blocks that most closely resemble them, we can construct trees (defined by the links) representing homogeneous parts of the input image. In this paper, we apply this approach to segmenting an image on the basis of texture. We start from an initial decomposition of the image into small blocks (e.g., 8 by 8); compute a textural property for each block, yielding an array of property values; build a 'pyramid' of reduced-resolution versions of this array; and apply the node linking process to this pyramid. The resulting trees define a segmentation of the original image into unions of the small blocks. This segmentation is similar to that obtained by minimum-error thresholding of the textural property values. Substantially better results are obtained when this 'bottom-up' block linking process is preceded by a 'top-down' process in which large homogeneous blocks are linked to all of their subblocks; the bottom-up linking is then used only for the blocks that were not linked by the top-down process. Author (GRA)

N81-24747# General Electric Co., Syracuse, N.Y.

SELF-DIAGNOSING DESIGN TECHNIQUES Final Report, 15 Jun. 1977 - 30 Jun. 1978

R. W. Heckelman 30 Jun. 1978 171 p refs

(Contract F33615-77-C-1106)

(AD-A098016; AFAL-TR-78-183) Avail: NTIS HC A08/MF A01 CSCL 09/2

A study and analysis of architectures, functional partitioning, and module and component features, required to achieve self-diagnosing microprogrammable capabilities in processors, is described. The results of the self-diagnosing techniques study, which apply to large scale integrated (LSI) circuits, are summarized in a set of design guidelines. Application of these guidelines to a selected baseline, a digital fly-by-wire aircraft flight control system, has resulted in the design of a self-diagnosing, fault tolerent processor possessing 'failed op(2)' fault tolerance and a probability of failure = 1 x 10 to the -9th power for a two hour mission. Triplication is employed throughout the design because of the requirement to achieve correct operation after the detection of a second error. Functional, complementary partitioning of the requirements leads to an implementation that can be matched to highly integrated devices. A bit-slice processor implements the application requirements, while the error processing and processor redundancy management is handled by a computer-on-chip (COC) family of devices. Specially designed self-checking checkers and partition interconnections devices provide comprehensive and extended error protection and interlocked reconfiguration control with respect to both consistent and inconsistent errors. GRA

N81-24748# General Electric Co., Pittsfield, Mass. Ordnance Systems Dept.

ELECTRICAL CHARACTERIZATION OF SINGLE CHIP MICROPROCESSORS AND LSI DEVICES Final Technical Report, Apr. 1978 - Sep. 1980

Barney W. Hajduk, Thomas M. Ostrowski, Donald Tucker, John Luzzi, Mark Peronto, Tom Wetzrl, James Schwehr, Lawrence DeLuca, and Richard English Feb. 1981 140 p

(Contract F30602-78-C-0189; AF Proj. 2338)

(AD-A097897; RADC-TR-81-10) Avail: NTIS HC A07/MF A01 CSCL 09/2

The objective of this effort was to develop functional and parametric tests for selected microprocessors and to develop MIL-M-38510 slash sheets for them. A test pattern and program were developed for the 8086 and data was taken and analyzed to determine its operating region. The procedure for LSI functional development, which was used on this and previous RADC contracts, was updated. The applicability of a dedicated benchtop tester to MIL-M-38510 testing was reviewed. GRA

N81-24749# Boston Coll., Chestnut Hill, Mass. Space Data Analysis Lab.

DATA ANALYSIS SYSTEMS AND DATA BASE DEVELOPMENT FOR THE S3 SATELLITES Final Report, 1 Feb. 1976 -31 Dec. 1979

Dennis E. Delorey and Paul N. Pruneau 31 Jan. 1980 119 p

(Contract F19628-76-C-0190)

(AD-A097748; BC-SDAL-80-2; AFGL-TR-80-0006) Avail: NTIS HC A06/MF A01 CSCL 09/2

Data bases have been developed for the S3-1, S3-2 and S3-3 satellites. A data analysis system has been developed for the S3-4 satellite. Summaries of the efforts involved with S3-1, S3-2 and S3-3 vehicles are provided. Full data base definitions for these vehicles are included. The S3-4 data analysis system is defined and Air Force Geophysics Laboratory payloads are described. Analysis requirements for these payloads are included. Spacecraft telemetry and operational models are outlined. GRA

N81-24750# Federal Computer Performance Evaluation Simulation Center, Washington, D. C.

COMPUTER SCIENCE AND TECHNOLOGY: COMPUTER MODEL DOCUMENTATION GUIDE Final Report

Jan. 1981 61 p refs

(PB81-152118; NBS-SP-500-73; LC-80-600190) Avail: NTIS HC A04/MF A01 CSCL 09B

Guidelines to preparing documentation for computer models are presented. Recommended structures for four types of manuals providing model information for four different classes of audiences (managers, users, analysts, and programmers) is presented. This document specifies the content of sections and subsections for each type of manual. Manuals prepared using these guidelines

will enable persons interested in a model to understand the capabilities and limitations of that model. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N81-24751 Rensselaer Polytechnic Inst., Troy, N. Y.
ONE-DIMENSIONAL AND TWO-DIMENSIONAL RECURSIVE DIGITAL FILTERS USING SPLINE FUNCTIONS Ph.D. Thesis
Chul-Sung Kim 1980 173 p
Avail: Univ. Microfilms Order No. 8109315

The problem of smoothing a set of 2 dimensional (or 1-dimensional) noise corrupted data is discussed. This smoothing problem is formulated as an optimal surface (or curve) fitting problem arising in approximation theory. A recursive procedure is developed which computes smoothed estimates by fitting 2 dimensional (or 1 dimensional) smoothing splines in a recursive manner. The amount of computation for this recursive procedure increases only linearly with the size of the data. Also, the smoothing algorithms both in 1 dimension and in 2 dimensions can be implemented on line. The resultant 1 dimensional recursive smoothing algorithm is optimal in that it provides an exact solution to a curve fitting problem. However, the 2 dimensional recursive algorithm as a solution to a surface fitting problem becomes suboptimal due to some approximations introduced in its derivation. The performances of these recursive smoothing algorithms are demonstrated by estimating the function values and the derivatives of sinusoidal functions in both 1 dimension and 2 dimensions. Dissert Abstr.

N81-24752 Case Western Reserve Univ., Cleveland, Ohio.
A MULTI-PROCESSOR BASED SELF-ADAPTIVE, SELF-SELECTIVE CONTROL ALGORITHM Ph.D. Thesis
Aviram Margalith 1981 314 p
Avail: Univ. Microfilms Order No. 8109597

A multi-processor control algorithm which is self-adaptive and self-selective was developed, designed and constructed. The control algorithm is designed to control a second-order system and to produce optimum results for step and ramp changes in the set-point and improved response for load changes. The algorithm is designed to adapt to changes in the gain and time constants of the system. Two and three processors designs are proposed. The two processor design is constructed based on the Intel 8080 and 8085 microprocessors. Dissert. Abstr.

N81-24753 Maryland Univ., College Park.
THE REPRESENTATION AND MANIPULATION OF POSITION INFORMATION USING SPATIAL RELATIONS Ph.D. Thesis
Robert Lee Haar 1980 234 p
Avail: Univ. Microfilms Order No. 8110290

Two different types of computational models of spatial relations are examined. First, each relation can be modelled as a compatibility function which specifies the degree to which positions satisfy that relation. These compatibility functions may be used to produce a relational scene description from position information or, conversely, to estimate the positions of objects from a relational description. The latter is called the Layout Problem and is solved using a relaxation labelling technique. Alternatively, spatial relations can be modelled in the symbolic domain through a system of inference (or deduction) rules which specify how the spatial relations are interrelated. When coordinate position is also represented in terms of artificially created relations, such inference rules provide a symbolic method for solving the layout problem. Dissert. Abstr.

N81-24754 Illinois Univ. at Urbana-Champaign.
ON THE DESIGN AND SCHEDULING OF AN INDEX PROCESSING SYSTEM FOR VERY LARGE DATA BASES Ph.D. Thesis
Hui-Ming Huang 1980 163 p
Avail: Univ. Microfilms Order No. 8108547

The organization and operation of an index processing system which offers speed increases in forming composite lists of pointers of interest from separate lists is discussed. The effects of the design parameters, such as merge network configuration, disk storage system architecture, query complexity and arrival rate, and postings list length and overlaps, on the performance of this system are examined, using both analytical techniques and simulations. Five algorithms for scheduling the merge trees are also defined and their effects on system performance studied. Results allow the implementor of a very large text database to select the system configuration and scheduling algorithms which would produce the greatest performance under a specific users software environment. Dissert. Abstr.

N81-24755 Illinois Univ. at Urbana-Champaign.
QUERY OPTIMIZATION FOR RELATIONAL DATABASE SYSTEMS Ph.D. Thesis
Won Kim 1980 161 p
Avail: Univ. Microfilms Order No. 8108563

An algorithm for computing the Cartesian product and join of large relations which attempts to take maximum advantage of available main-memory buffer space is developed. A sorting technique for application in query processing is proposed which attempts to exploit the query and database characteristics as well as the available main-memory buffer space. The syntactical structure of a block-structured query language is analyzed to expose the basic structures which constitute a general nested query to arbitrary complexity. Algorithms for efficiently processing each of the basic structures are developed and a coherent strategy for processing a general nested query is constructed by merging the basic algorithms. The problem of optimizing a set of queries and data manipulation statements is addressed. The strategy proposed is based on a compile-time analysis of queries embedded in some algorithmic programming language to determine those queries that can be simultaneously processed. Dissert. Abstr.

N81-24756 Illinois Univ. at Urbana-Champaign.
PARALLEL ALGORITHMS FOR GEOMETRIC PROBLEMS Ph.D. Thesis
Anita Liu Chow 1980 163 p
Avail: Univ. Microfilms Order No. 8108465

Design and analysis algorithms are described for solving geometric problems on two parallel computing systems: the Shared Memory Machine (SMM) and the Cube-Connected-Cycles (CCC). Solutions to geometric problems can be organized to reveal a large amount of parallelism, which can be exploited to substantially reduce the computation time. The algorithms for reporting intersection of rectangles and for constructing the two dimensional convex hull on the CCC have the same time complexity as that on the SMM. With an increase in the number of processors of the CCC, all these problems are solved with algorithms of time complexity improved by a factor of 1/(alpha) log N with respect to that on the CCC with N number processors.
Dissert. Abstr.

N81-24757 Illinois Univ. at Urbana-Champaign.
A CELLULAR AUTOMATA APPROACH TO COMPUTER VISION AND IMAGE PROCESSING Ph.D. Thesis
George Daniel Hadden 1980 153 p
Avail: Univ. Microfilms Order No. 8108529

A system called HEXVIS is described which performs operations on scenes. All operations are carried out in a hexagonal array of cellular automata-like objects which corresponds to that scene. The system can perform the following task; recognition of edges, corners, and axes of symmetry, texture discrimination, determination of areas, and generation of Voronoi tessellations. First, the scene is embedded in the hexagonal array. Then the cells pass messages describing the cell's contents to their neighbors which, in turn, pass them on. As these messages pass through cells, they can interact with each other and with the contents of the cell in which they find themselves. The cells perform the same operation or group of operations in parallel on their visting messages. As a consequence of these operations, the states of some cells change in a way which indicates that they correspond to interesting parts of the scene. Dissert. Abstr.

N81-24758 Stanford Univ., Calif.
AN O(nmLOG n) ALGORITHM FOR MAXIMUM NETWORK

FLOW Ph.D. Thesis
Daniel Dominic Kaplan Sleator 1981 81 p
Avail: Univ. Microfilms Order No. 8108998

The algorithm finds a maximum flow in O(nmlog n) time, which is a factor of log n faster than the previous fastest algorithm. The central innovation is a sophisticated data structure that is used to represent a certain subset of edges that form a forest. The edges of this forest are further partitioned into two classes: broken and solid. Long paths of solid edges are grouped together and stored in a balanced tree data structure called biased 2-3 tree. Each leaf of the biased 2-3 tree corresponds to an edge in the path. It appears that this data structure can be used to get fast algorithms for other problems such as the transshipment problem, the deepest common ancestor problem where a cut operation is allowed, and the two color minimum spanning tree problem. Dissert. Abstr.

N81-24759 Yale Univ., New Haven, Conn.
PAGING AS A LANGUAGE PROCESSING TASK Ph.D. Thesis
Michael William Condry 1980 239 p
Avail: Univ. Microfilms Order No. 8109660

The task of paging a program managed as a language processing problem. This with the language APL is investigated. The approach taken is like an optimization problem where the language semantics are analyzed and techniques developed for automatically generating an efficient paged implementation of an APL expression. A method for organizing array data into pages, called BOX, is introduced and proves to be an efficient means for managing the potentially diverse array shapes and computation needs. Storage utilization of BOX is compared to other methods and is found to be efficient. A model of the APL semantics is developed that is more powerful for APL than previous models, and its design allows the relationships between computation and paging to be easily exhibited. Using this model, a systematic scheme for formulating efficiently paged APL computations is developed. With this scheme, it becomes straightforward for a programming language processor to generate the necessary paging actions for a program. From the scheme, procedure for APL are generated and compared to existing alternatives. Dissert. Abstr.

N81-24760 Washington Univ., Seattle.
DECIDABILITY AND EXPRESSIVENESS OF LOGICS OF PROCESSES Ph.D. Thesis
Karl Raymond Abrahamson 1980 173 p
Avail: Univ. Microfilms Order No. 8109709

Several logics of processes are examined. The logics GPL and MPL are based on a second order tense logic, where the two types of variable range over computation sequences and points on computation sequences. GPL is a version of the predicate calculus similar to Parikh's general logic. MPL is a modal logic, and is the only modal process logic which incorporates two fundamentally different types of modality. A tableau method for deciding validity in MPL, based on a type of directed graph, called an LL graph is presented. From the tableau method a complete proof system for MPL is derived. Differences between GPL and MPL are discussed. MPL is decidable in double exponential time while even a proper subset of GPL, which can express the same properties as MPL, is nonelementary. It is shown that GPL is decidable only when processes are tree-like, in Parikh's sense. In contrast, the method for deciding MPL in general requires processes which are not tree-like. Extensions to PDL are also studied. Dissert. Abstr.

N81-24761 Idaho Univ., Moscow.
STRUCTURE IDENTIFICATION OF STATIONARY LINEAR MULTIVARIABLE SYSTEMS FROM INPUT-OUTPUT DATA Ph.D. Thesis
John Edwards Purviance 1980 78 p
Avail: Univ. Microfilms Order No. 8108744

A structure identification algorithm for linear multivariable systems is described which uses operating input-output data and permits colored measurement and process noise as well as control inputs. Structure is defined on the set of controllable and observable, strictly proper, stationarly, linear, discrete-time multivariable systems to be a set of integers, the system's Kronecker invariants. It is shown that structure bounds the degree of every element in its canonical system model. Structure identification locates a model to within an equivalence class of structurally equivalent canonical models and it is shown that parameter estimation is necessary to uniquely distinguish among models that are structurally equivalent. Dissert. Abstr.

N81-24762*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VIKING LANDER CAMERA GEOMETRY CALIBRATION REPORT. VOLUME 1: TEST METHODS AND DATA REDUCTION TECHNIQUES
Michael B. Wolf 15 Apr. 1981 43 p Sponsored by NASA (NASA-CR-164359; JPL-Pub-79-54-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 09B

The determination and removal of instrument signature from Viking Lander camera geometric data are described. All tests conducted as well as a listing of the final database (calibration constants) used to remove instrument signature from Viking Lander flight images are included. The theory of the geometric aberrations inherent in the Viking Lander camera is explored. A.R.H.

N81-24763# Engins Matra, Velizy (France).
RAM 93L 422. PRE-EVALUATION
E. Rabeyrin, ed. 14 Aug. 1980 13 p In FRENCH (DX-70/0.371) Avail: NTIS HC A02/MF A01

Because of its speed and the possibility of its integration without supplementary packaging into the modules of existing microprocessors, the 93 L 422 (bipolar technology) RAM was studied as an alternative to the HM 6561 CMOS (256 x 4) RAM which has great sensitivity to radiation. Performances of the two random access memories are compared in tables. The effects of radiation on the 93 L 422 are also tabulated. Results show that (1) the 93 L 422 has greater consumption and occupies more space; (2) radiation tolerance of the 93 L 422 is unquestionably superior to the MOS technology HM6561, even though one specimen failed between 15 kRAD and 45 kRAD; (3) the great density of integration does not prohibit use of the component in high reliability projects; and (4) for better understanding of the component, electrical evaluation with static and dynamic measurements, done in a group of accelerated life tests, is required. Transl. by A.R.H.

N81-24764# Texas Univ. at Arlington. Linguistics Research Center.
THE METAL SYSTEM, VOLUME 1 AND 2, APPENDICES Final Technical Report, 28 Mar. 1978 - 27 Oct. 1980
Winfred P. Lehmann, Winfield S. Bennett, Jonathan Slocum, Howard Smith, and Solveig M. V. Pfluger Jan. 1981 280 p (Contract F30602-78-C-0132; AF Proj. 4594) (AD-A097896; RADC-TR-80-374-Vol-1; RADC-TR-80-374-Vol-2) Avail: NTIS HC A13/MF A01 CSCL 05/7

The report documents the results of a 30 month effort directed at the implementation of phase 2 of three R D phases originally projected for completion of a comprehensive operational capability for German-English machine translation. METAL is an advanced machine translation system of tripartite design, i.e., it consists of three components; a lexicon, a grammar and a set of computational rules. The latter can be used with the lexicon and grammar of any natural language involved in a machine translation process. Consequently, linquistic updating does not require corresponding changes in the repertory of computational rules. The system represents a third generation approach to machine translation based on lexical, syntatic/semantic and pragmatic knowledge bases traditionally associated with competent human translation. The output of METAL is produced in natural language, rather than in 'machinese'. Section 3 of the report discusses the operation of METAL in terms of its functional characteristics. Sections 4 and 5 provide a detailed description of linguistic component and programming implementation. Section 7 contains the results of testing on live data in a quasi operational environment. METAL can be run in batch mode on the CDC 6600 (LISP version) and in an interactive mode on the DEC PDP 20 (INTERLISP version). GRA

N81-24765# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
EMACS: THE EXTENSIBLE, CUSTOMIZABLE SELF-

DOCUMENTING DISPLAY EDITOR
Richard M. Stallman 26 Mar. 1981 30 p
(Contract N00014-80-C-0505)
(AD-A097914; AI-M-519A) Avail: NTIS HC A03/MF A01 CSCL 09/2

EMACS is a display editor which is implemented in an interpreted high level language. This allows users to extend the editor by replacing parts of it, to experiment with alternative command languages, and to share extensions which are generally useful. The ease of extension has contributed to the growth of a large set of useful features. This paper describes the organization of the EMACS system, emphasizing the way in which extensibility is achieved and used. GRA

N81-24766# Pennsylvania Univ., Philadelphia. Inst. for Statistics and Applications.
USER'S MANUAL: MONCOR-A PROGRAM TO COMPUTE CONCORDANT AND OTHER MONOTONE CORRELATIONS Interim Report
George Kimeldorf, Jerrold H. May, and Allan R. Sampson Jan. 1981 14 p refs Prepared in cooperation with Texas Univ. at Dallas
(Contract F49620-79-C-0161; Grant NSF MCS-80-02152; AF Proj. 2304)
(AD-A098145; CPSS-TR-81; AFOSR-81-0377TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

A User's Manual is provided for the interactive FORTRAN program MONCOR which computes the concordant monotone correlation, discordant monotone correlation, isoconcordant monotone correlation, isodiscordant monotone correlation and their associated monotone variables. Data input are ordinal contingency tables in matrix form. Author (GRA)

N81-24767# Purdue Univ., Lafayette, Ind. School of Chemical Engineering.
INVESTIGATION OF THE COMPUTATIONAL UTILITY OF GEOMETRIC PROGRAMMING FORMULATION AND ALGORITHMS Final Report, 1 Jan. - 31 Dec. 1979
G. V. Rekaitis Jan. 1981 200 p refs
(Contract N00014-76-C-0551)
(AD-A098245) Avail: NTIS HC A09/MF A01 CSCL 12/1

This project proposes to investigate the effectiveness of prototype and generalized geometric programming (GP) developments in the routine solution of inequality constrained algebraic programs. The research seeks to elucidate under what conditions which of the equivalent prototype GP problem forms: primal, convexified primal, transformed primal, and/or transformed dual, as well as their generalized GP analogous are best solved and under what conditions. Moreover, direct and sequential strategies will be examined to identify the most efficient strategies for the solution of GGP's. The computational tests in the study will be performed using the leading specialized GP and GGP codes as well as a selection of general nonlinear programming codes. Statistical tests will be employed to deduce suitable measures of prototype and generalized GP problem difficulty.Author (GRA)

N81-24768# Maryland Univ., College Park. Computer Vision Lab.
IMAGE PROCESSING ON MPP Interim Report
Todd Kushner, Angela Y. Wu, and Azriel Rosenfeld Feb. 1981 35 p refs
(Grant AF-AFOSR-3271-77; AF Proj. 2304)
(AD-A098121; TR-1007; AFOSR-81-0367TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

The Massively Parallel Processor (MPP) is a 128 by 128 array of processing elements that communicate with their horizontal and vertical neighbors by shifting data one bit at a time. This paper describes the efficient use of MPP for various types of image processing operations, including point and local operations, discrete transforms, and computation of image statistics. A comparison between MPP and ZMOB (a system consisting of 256 microprocessors) is also presented. Author (GRA)

N81-24769# Maryland Univ., College Park. Dept. of Computer Science.
ASSERTION MECHANISMS IN PROGRAMMING LANGUAGES Interim Report
Marvin V. Zelkowitz and James R. Lyle Nov. 1979 33 p refs
(Contract F49620-80-C-0001; AF Proj. 2304)
(AD-A098069; AFOSR-81-0365TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

Assertions typically are used to verify program behavior. However, the use of an assertion to cause a run-time exception can have practical benefits. We take this view that an exception is such an assertion failure. The implementation of assertions in a PL/I compiler is described, and the interface with the exception mechanism of PL/I (ON-units) is described. Principle usages include: test data set evaluation and extension of the domain of abstract data type specifications. Author (GRA)

N81-24770# Ballistic Research Labs., Aberdeen Proving Ground, Md.
FINLIE: A FORTRAN PROGRAM FOR FITTING ORDINARY DIFFERENTIAL EQUATIONS WITH NONLINEAR PARAMETERS TO DATA Final Report
James W. Bradley Feb. 1981 95 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A098038; AD-E430585; ARBRL-TR-02290) Avail: NTIS HC A05/MF A01 CSCL 12/1

This paper presents and documents a FORTRAN program FINLIE for fitting a system of ordinary differential equations (or a system of algebraic or transcendental equations) to observed data. FINLIE determines those values of the possibly nonlinear system parameters and initial conditions that yield a best fit - in the least squares sense - of the solution curves to measurements of one or more of the dependent variables. The basic fitting technique is Chapman-Kirk, with the Marquardt algorithm aiding convergence. The data from more than one experiment can be handled simultaneously to obtain one common set of parameters and set of initial conditions for each experiment. For each computer run, the value of any parameter or initial condition can be held fixed or adjusted by FINLIE. GRA

N81-24771# Naval Aerospace Medical Research Lab., Pensacola, Fla. Bureau of Medicine and Surgery.
A PROCESS CONTROL SYSTEM FOR HEWLETT-PACKARD SERIES 21XX COMPUTERS
John R. Bowman, Gregory Q. Thorsen, and Douglas E. Carrell Aug. 1980 118 p ref
(ZF51524004)
(AD-A097770; NAMRL-SR-81-1) Avail: NTIS HC A06/MF A01 CSCL 09/2

The Vision Research Division of the Naval Aerospace Medical Research Laboratory needed a computer system to control psychophysical experiments that would remove the need for in-depth knowledge of complex computer languages by investigators. It was required that this system utilize a Hewlett-Packard 2100 series computer. The State Diagram System (SDS) was developed to solve this problem. SDS is a tool that can be used by investigators in designing and running psychophysical experiments on Hewlett-Packard's HP-2100 series computers. SDS, as presently designed, is capable of running only those experiments that use discrete inputs and outputs. The system offers the investigator a high level language with which he is already familiar or can easily learn, thus removing the burden of solving these types of problems using more complex computer languages. Written in FORTRAN IV language SDS is an interactive system that does not require assembling or compiling of its programs. The system accepts source language statements from either the system console or disc files and allows the program to be run immediately upon completion of this input process. While SDS does not solve all of the problems encountered in computerizing psychological experiments, its modular design should ease such future modifications as dealing with continuous variables, calling external programs, and controlling multiple experiments. Author (GRA)

N81-24772# University of Southeastern Massachusetts, North Dartmouth. Dept. of Electrical Engineering.
NOTE ON STATISTICAL TEXTURE DISCRIMINATION
C. H. Chen and Rong-Hwang Wu 24 Apr. 1981 25 p refs
(Contract N00014-79-C-049; NR Proj. 042-422)
(AD-A098285; SMU-EE-TR-81-9) Avail: NTIS HC A02/MF A01 CSCL 09/2

For a given textured image, experimental results on texture feature extraction, dimensionality reduction, and iterative Bayes

classification are reported. The classification performance is superior to other texture discrimination methods that have been examined on the same data. While the method presented is recommended as an effective statistical texture discrimination approach, the large amount of computation required, especially in feature extraction, can be undesirable in some applications. Detailed computer program listing is given in the appendix. GRA

N81-24773# Science Applications, Inc., Palo Alto, Calif.
SPASM: A COMPUTER CODE FOR MONTE CARLO SYSTEM EVALUATION Final Report
F. L. Laveranz Jan. 1981 34 p refs Sponsored by Electric Power Research Inst.
(EPRI Proj. 1233-1)
(EPRI-NP-1685) Avail: NTIS HC A03/MF A01

System Probabilistic Analysis by Sampling Methods (SPASM) is a computer code in the WAM family which evaluates the distribution of system success of failure frequency via Monte Carlo simulation. It can be used independently of or in conjunction with WAMCUT. DOE

N81-24774# Centre Technique des Industries Mecaniques, Senlis (France).
COMPUTER PROGRAM FOR ANALYSIS OF REAL LOAD CYCLES Final Report [PROGRAMME ANALYSE CYCLES CHARGES REELLES]
R. Gregoire Jul. 1980 184 p In FRENCH
(CETIM-12-A-212) Avail: NTIS HC A09/MF A01

A program package for statistical amplitude analysis of a numerical integral corresponding to the sequence of extremes of a solicited signal is presented. Utilization of results in designing fatigue simulation tests is shown. Depending on the choice of statistical method for estimating service life, four subroutines are offered. Functional application, implementation, and details of the output are described for each program. Also given are parametric conditions on the significance of the statistical analysis (mean value, secondary oscillations) as well as output formalisms (errors, printout, computer graphics). Author (ESA)

N81-24775# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.
A PROSPOSAL FOR THE CO6 CHAPTER OF THE NAG ALGOL 68 LIBRARY
C. G. vanderLaan (Groningen Univ., Netherlands) Sep. 1980 89 p refs
(MC-TW-208/80) Avail: NTIS HC A05/MF A01

Operators in ALGOL 68 and their documentation are given for the problems connected with the discrete Fourier transform and the evaluation of trigonometric sums. Storage requirements and timing data are included. Unit bounds for propagated and generated errors are given. Source texts are listed. Author (ESA)

N81-24776# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Mathematische Verfahren und Datentechnik.
COMPUTER GENERATED DRAWING OF LEVEL LINES
Hans-Kurt Schulze Nov. 1980 48 p refs In GERMAN; ENGLISH summary
(DFVLR-FB-80-37) Avail: NTIS HC A03/MF A01

A generally applicable method for computer generated drawing of isopleths, e.g., noise level isograms, was developed and programmed in ALGOL and FORTRAN. Node points in a cross-sectional lattice network are used to determine constitutive values of a surface $z = f(x,y)$. The flexibility of the method is pointed out, and possible application to topological cross-sectional display is mentioned. The computational scheme and computer program are described. The program was tested for the graphic display of maximum perceived noise level to effective perceived noise level for four different aircraft maneuvers over land. The demonstration, using an HFB 320 Hansa aircraft, shows satisfactory results. Author (ESA)

N81-24777# Mitre Corp., McLean, Va. METREK Div.
COBOL PROGRAMMER'S REFERENCE MANUAL Final Report
Carole Roelofs Jul. 1980 742 p Sponsored in part by New York State Dept. of Labor, Albany
(PB81-141764; MTR-7942-Rev-1) Avail: NTIS HC A99/MF A01 CSCL 09B

Several major vendor's COBOL 74 reference manuals were investigated to determine the areas of commonality and difference. Unlike the American National Standards COBOL functions, this document addresses the existing capabilities as actually implemented by the vendors. The objective is to provide the data processing staff, with a usable COBOL programming handbook that spells out the common vendor capabilities, and offers approaches for handling differences in required functions. GRA

N81-24778# Federal Compiler Testing Center, Washington, D.C.
FEDERAL CSS, INC., IBM 360/370 OS/VS COBOL RELEASE 2.3 PTR 8
21 Jan. 1981 59 p
(PB81-151409; CCVS74-VSR645) Avail: NTIS HC A04/MF A01 CSCL 09B

The validation of the Federal CSS, IBM 360/370 OS/VS COBOL Compiler Version 2.3 PTFB against the 1974 COBOL Standard is summarized. An overview of the validation lists all categories of discrepancies by level/module within the standard. A section relating the categories of discrepancies to each of the Federal levels of the language, and a detailed listing of discrepancies together with the tests which were failed are included. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N81-24779* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
COMMON DATA BUFFER SYSTEM Patent
Frank Byrne, inventor (to NASA) Issued 3 Mar. 1981 11 p Filed 23 Mar. 1979 Supersedes N79-23674 (17 - 14, p 1891)
(NASA-Case-KSC-11048-1; US-Patent-4,254,464; US-Patent-Appl-SN-023437; US-Patent-Class-364-200;) Avail: US Patent and Trademark Office CSCL 09B

A high speed common data buffer system is described for providing an interface and communications medium between a plurality of computers utilized in a distributed computer complex forming part of a checkout, command and control system for space vehicles and associated ground support equipment. The system includes the capability for temporarily storing data to be transferred between computers, for transferring a plurality of interrupts between computers, for monitoring and recording these transfers, and for correcting errors incurred in these transfers. Validity checks are made on each transfer and appropriate error notification is given to the computer associated with that transfer. Official Gazette of the US Patent and Trademark Office

N81-24780 Illinois Univ. at Urbana-Champaign.
PERFORMANCE MODELS FOR MULTIPROCESSOR COMPUTER SYSTEMS Ph.D. Thesis
David Wei-Luen Yen 1980 189 p
Avail: Univ. Microfilms Order No. 8108710

The memory interference in multiprocessor systems with time division multiplexed busses is discussed. Emer's model for multiple instruction stream pipelined processor with a single fixed cycle shared resource is addressed. Generalizations of that model for systems with multiple resources, resources having more general cycle times and/or unassigned time slots are discussed. Provisions for the application of the model to programs with critical sections treated as software resource are also covered. Two other models for matrix multiplication execution are also presented for comparison. These two models model the imperfect job sharing among processors at the end of a computation, which has not been previously modeled. A general model for the memory interference in synchronous multiprocessor systems which allow arbitrary memory request rates, nonuniform memory references, and unequal processor priorities is presented next. For the case of uniform memory access, an improved model based on a steady flow concept is discussed. Several application examples which make use of the memory interference models derived are presented. Dissert. Abstr.

N81-24781# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Informatique.
PERFORMANCE ANALYSIS OF A TWO COMPUTER SYSTEM
Guy Pujolle and Adam Wolitz (Polish Academy of Sciences, Gliwice, Poland) 1980 30 p ref Submitted for publication (ENST-C-80002) Avail: NTIS HC A03/MF A01

A system where an in-house minicomputer is linked to a large machine through a time sharing facility is analyzed for a class of job scheduling problems. Two stage tandem queueing networks are used to model such a system under different assumptions, depending on the priority- access to the large computer. Several parameters characterizing the throughput of such an installation are calculated. They are compared with the parameters of two limiting cases: (1) no access to the large machines is established; and (2) every job sent to the large machine is always accepted. Illustrative numerical examples are provided. Author (ESA)

N81-24782 International Institute for Applied Systems Analysis, Laxenburg (Austria).
REMOTE FILE ACCESS: A DATA ACCESS PROTOCOL FOR COMPUTER NETWORKS
F. Caneschi and M. Sommani Dec. 1980 39 p refs (IIASA-RR-80-43) Avail: Issuing Activity

A system service, remote file access (RFA), which permits a user to have access to data files stored physically in remote computers without transferring either all the data or the associated program from one computer to another is proposed. For networking, the RFA protocol can be considered an application. A restricted implementation was carried out in connection with the Italian computer network RPCNET. Unfortunately, no standards exist for the end-to-end protocol. Based on assumptions, the interaction between the application protocol (RFA) and the end-to-end protocol is described, although not formally. A detailed listing of the RFA data channel protocol is then given. Author (ESA)

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

N81-24783 Texas Univ. at Arlington.
QUEUEING NETWORK MODELS OF COMPUTER SYSTEMS: CHARACTERIZATION AND COMPUTATION Ph.D. Thesis
Andrew James Martin 1980 144 p
Avail: Univ. Microfilms Order No. 8109202

The characterization of product form queueing network models and some computational techniques for solving queueing network models are discussed. A characterization theorem is proved for product form queueing network models, including those in which the service discipline does not treat all customers alike. Moreover, this characterization is given in terms of service disciplines and service time distributions and so is meaningful to system designers. Mixed queueing networks contain at least one open chain and one closed chain. Such networks can arise when the computer or communication system being modelled shares different workloads. An efficient, general algorithm for numerical solution of mixed product form networks is given. An approach to the implementation of an exact decomposition scheme for open and mixed product form queueing network models is also developed. An algorithm for modelling memory contention with multiple customer classes is introduced and the computational results of using the algorithm are discussed. Dissert. Abstr.

N81-24784 Stanford Univ., Calif.
AN ORGANIZATION FOR PROGRAMS IN FLUID DOMAINS Ph.D. Thesis
Richard Paul Gabriel 1981 223 p
Avail: Univ. Microfilms Order No. 8108928

An organization for very large artificial intelligence programs is presented with a detailed example in the area of natural language generation. The concept of a fluid domain is defined and shown to introduce constraints on the type of program organization required in such domains. The organization is a community of stratifications which communicate with each other in a fairly loose manner. Each Stratification is a hierarchy of individuals, called units, organized in meta-object/object relationships; these relationships allow observation and description of some units by others. It is shown that a great deal of power obtains from organizations of this type and from the interactions between the objects that exist in such systems. Further, this organization is demonstrated to be a valuable method of viewing both intelligence and the programming structures needed to produce intelligence. The structure of a linguistic communication is related to the organization of the units in the system. The notion of hybrid matching of symbolic descriptions with associated measures is explored, in which strength of description, general stylistic influences, and specific contextual influences affect the outcome of a match. Dissert. Abstr.

N81-24785 Yale Univ., New Haven, Conn.
GLOBAL STABILITY OF MODEL REFERENCE ADAPTIVE CONTROL SYSTEMS Ph.D. Thesis
Yuan-Hao Lin 1980 219 p
Avail: Univ. Microfilms Order No. 8109801

A solution to the problem of stability in the large of adaptive control systems is presented. The adaptive control of a class of single input single output linear time invariant systems with unknown parameters is specifically addressed. Using simple controller structure and adaptive laws in both discrete and continuous systems the stability in the large is demonstrated in a unified manner. This assures that the control parameters will converge to stable values from any arbitrary initial conditions so that all signals involved in the closed adaptive loop are uniformly bounded and the output of the plant being controlled tends to the desired value asymptotically. Dissert. Abstr.

N81-24786# Sheffield Univ. (England). Dept. of Control Engineering.
ON THE EFFECT OF NONLINEARITIES IN MULTIVARIABLE FIRST ORDER PROCESS CONTROL
D. H. Owens Sep. 1980 6 p refs Presented at IEE Intern. Conf. on Control and its Appl., Conventry, England, Mar. 1981 (Grant SRC-GR/B/23250) (RR-121) Avail: NTIS HC A02

The use of discrete and continuous, first order, linear, multivariable, approximate models as the basis of controller design is discussed. Large scale and/or badly defined linear engineering systems where the output measurements is the sum of memoryless bounded and finite incremental gain forms are emphasized. The effect of measurement nonlinearities on closed loop system stability and performance is shown to be assessible using elementary calculations based on the nonlinearity and the responses of the approximately linear feedback system. The techniques have the advantage that high performance closed loop systems can be designed using only simple properties of system matrices or plant transient response data. Author (ESA)

N81-24787# Delaware Univ., Newark. Applied Mathematics Inst.
DIRECT AND INVERSE PROBLEMS IN OBSTACLE SCATTERING FOR APPLICATION IN DETECTION, IDENTIFICATION AND COMMUNICATION Final Report, Jan. 1979 - Jan. 1981
T. S. Angell and R. E. Kleinman Feb. 1981 7 p refs (Grant AF-AFOSR-0085-79; AF Proj. 2304) (AD-A098144; AFOSR-81-0369TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Research was carried out in three main areas: constructive solution methods for integral equations arising in scattering problems; analysis of time dependent scattering phenomena; and applications of boundary control methods in radiation and scattering problems. Author (GRA)

N81-24788# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
CONTROL OF A TENDON ARM
Kok Huang Lim Feb. 1981 86 p refs (Contract N00014-77-C-0389) (AD-A098089; AI-M-617) Avail: NTIS HC A05/MF A01 CSCL 09/2

The dynamics and control of a tendon driven three degree of freedom shoulder joint are studied. A control scheme consisting of two phases has been developed. In the first phase, approximation of the time optimal control trajectory was applied open loop to the system. In the second phase a closed loop linear feedback law was employed to bring the system to the desired final state and to maintain it there. Author (GRA)

N81-24789# Systems Technology, Inc., Hawthorne, Calif.
MULTI-RATE DIGITAL CONTROL SYSTEMS WITH SIMULATION APPLICATIONS. VOLUME 3: SOURCE LISTINGS Final Report, 29 Jan. 1979 - 29 May 1980
Dennis G. J. Didaleusky Wright-Patterson AFB, Ohio AFWAL Sep. 1980 116 p
(Contract F33615-79-C-3601; AF Proj. 2304)
(AD-A097864; STI-TR-1142-1-3-Vol-3; AFWAL-TR-80-3101-Vol-3) Avail: NTIS HC A06/MF A01 CSCL 09/2

The report is organized in three volumes. Volume 1 contains the theoretical developments as well as illustrative examples and case studies. Volume 2 describes two algorithms useful in the analysis of multi-rate systems, the DISCRET and TXCONV computer programs. Volume 3 contains the listings of all programs and subroutines which comprise DISCRET and TXCONV.
Author (GRA)

N81-24790# RAND Corp., Santa Monica, Calif.
TOWARD AN EXPERT AID FOR TACTICAL AIR TARGETING Interim Report
Monti Callero, Daniel Gorlin, Frederick Hayes-Roth, and Lewis Jamison Jan. 1981 60 p refs
(Contract MDA903-78-C-0029; ARPA Order 3460; ARPA Order 3473)
(AD-A097720; RAND/N-1645-ARPA) Avail: NTIS HC A04/MF A01 CSCL 09/2

This Note describes our initial efforts to apply recent advances in knowledge engineering to the domain of tactical air targeting. Tactical targeting is a critical function in war requiring many complex, heuristic, and time stressed decisions by the targeteer. A knowledge engineering approach to providing and aid for this process suits the domain. First, knowledge employed by targeteers does not lend itself to straightforward computer implementation. Second, no standard approach exists for targeting. Third, by 'engineering' targeteers' knowledge, a basis is provided for experimentation and reformulation of targeting concepts and practices. Finally, the operational environment requires effective human interaction and ready program modification. Knowledge engineering has greater potential to meet these needs than other programming approaches. Our research tests the hypotheses that an expert system would improve tactical targeting and that knowledge engineering can be extended to meet the task. The paper describes the technical and targeting environments, early project experiments, the latest targeting program, TATR, written in ROSIE-I, and our current approach using ROSIE-II.
Author (GRA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N81-24791 Illinois Univ. at Urbana-Champaign.
SELF ADAPTIVE METHODS FOR PARABOLIC PARTIAL DIFFERENTIAL EQUATIONS Ph.D. Thesis
Dennis Brooke Gannon 1980 92 p
Avail: Univ. Microfilms Order No. 8108510

Algorithms are considered for the proper construction of locally refined grids for finite element based methods for the solution to partial differential equations characterized by a sharp active region of transition surrounded by relatively calm stable regions. By extending the work of Babuska and Rheinboldt to the case of parabolic problems, refinement criteria are developed and tested for this class of problems. The computational complexity of such a strategy is studied, and algorithms based on nested dissection are presented to solve the associated linear algebra problems. Dissert. Abstr.

N81-24792 Stanford Univ., Calif.
GRAPH SEPARATOR THEOREMS AND SPARSE GAUSSIAN ELIMINATION Ph.D. Thesis
John Russell Gilbert 1981 102 p
Avail: Univ. Microfilms Order No. 8108929

Some divide and conquer algorithms on graphs are investigated. A graph problem can often be solved by cutting the graph into two or more pieces of roughly equal size, solving the problem on the pieces, and combining the partial results to get a solution to the original problem. The conditions under which a graph can be divided by removing a small set of vertices are considered. It is shown that if a graph and its subgraphs have square root separators, and the vertices have two independent sets of nonnegative weights, then the graph has a square root separator that cuts one kind of weight exactly in half and the other kind in half to within any specified tolerance. This result is used to prove that, in a graph with square root separators and vertices of average weight one, a fragment of any specified weight can be isolated with a separator whose size is proportional to the square root of the fragment's weight an algorithm for a combinatorial problem in numerical analysis concerning the preservation of zeroes in a large system of linear equations whose coefficients are nearly all zeroes. Dissert. Abstr.

N81-24793 Stanford Univ., Calif.
NUMERICAL SOLUTION OF THE BIHARMONIC EQUATION Ph.D. Thesis
Petter Erling Bjorstad 1981 85 p
Avail: Univ. Microfilms Order No. 8108895

The numerical solution of discrete approximations to the first biharmonic boundary value problem in rectangular domains is studied. Several finite difference schemes are compared and a family of fast algorithms for the solution of the discrete systems is developed. These methods are optimal, having a theoretical computational complexity of O(N squared) arithmetic operations and requiring N squared + O(N) storage locations when solving the problem on an N by N grid. Several practical computer implementations of the algorithm are discussed and compared. These implementations require aN(2) + bN(2) log N arithmetic operations with b << a. The algorithms take full advantage of vector or parallel computers and can also be used to solve a sequence of problems efficiently. A fast direct method for the biharmonic problem on a disk is also developed. It is shown how the method of solution is related to the associated eigenvalue problem. The results of extensive numerical tests and comparisons are included. Dissert. Abstr.

N81-24794 Minnesota Univ., Minneapolis.
THE SECOND VARIATION OF THE PONTRJAGIN NUMBER OF A FOUR DIMENSIONAL MANIFOLD EMBEDDED IN EUCLIDEAN EIGHT SPACE Ph.D. Thesis
Timothy Leslie Strotman 1980 57 p
Avail: Univ. Microfilms Order No. 8109513

A compact oriented four dimensional manifold M embedded in Euclidean eight space is considered. The Pontrjagin number of M is defined in terms of integrals defined on various bundles of M. Techniques similar to those used in studying the variation of arc length and surface area are used to define an (arbitrary) variation of this integral. The first and second derivatives of this variation are calculated. The first derivative is shown to be 0 at the limit. The variation induced by the tripod bundle is specifically considered. The second derivative is computed in terms of known geometric invariants. The resulting integral defies easy interpretation, even as to whether it vanishes. Finally the second variation for the complex Veronese surface is computed which is an embedding of the complex projective plane in E8. For this embedding the second derivative is 24 and, hence, does not vanish in general. This shows that the variation of the Pontrjagin number is not constant near the limiting position. Dissert. Abstr.

N81-24795 Illinois Univ. at Urbana-Champaign.
OPTIMIZATION, CONVERGENCE, AND DUALITY Ph.D. Thesis
Roy Clarence Bergstrom 1980 103 p
Avail: Univ. Microfilms Order No. 8108449

Convergence for a sequence of convex functions is considered. This convergence is preserved under the Fenchel transform, and is equivalent to a convergence which can be defined for the

sequence of subdifferentials corresponding to the given convex functions. Simple conditions are established under which this convergence is preserved under the operations of addition, infimal convolution, and composition with linear transformations. It is applied in a variety of optimization settings, including generalized convex programming, the Fenchel-Rockafellar perturbational duality scheme, network optimization, certain approximation problems, and linear programming. The convergence is studied in infinite dimensions, where some of the preservation properties are found to hold under suitable restrictions not necessarily requiring interiority. The idea of convergence of a sequence of subdifferentials is studied for general maximal monotone operators, and preservation of such convergence under addition of operators is investigated. Dissert. Abstr.

N81-24796 Illinois Univ. at Urbana-Champaign.
PROJECTIVELY EQUIVALENT METRICS SUBJECT TO CONSTRAINTS Ph.D. Thesis
William Lawrence Taber 1980 78 p
Avail: Univ. Microfilms Order No. 8108683

The relationship between pairs of projectively equivalent Riemannian or Lorentz metrics sharing some property along a hypersurface of a manifold is considered. It is assumed the two metrics, g and g^*, induce the same Riemannian metric on a hypersurface, H, of a manifold, M, having dimension greater than two, H having nondegenerate second fundamental form. It is established that, unless H possesses strong symmetry with respect to M, the two metrics agree throughout M. The situation in which the two metrics are distinct is then investigated. In this setting, the structure of (M,g) is strongly determined by the number of conformal points in M. Conditions sufficient to insure that the restricted metrics are global warped product metrics are given. Properties of H and M under differing conditions are considered. A result to higher dimensional Riemannian manifolds is generalized. Dissert. Abstr.

N81-24797 Clemson Univ., S.C.
A STUDY OF THE M-CENTER PROBLEM USING CHORDAL GRAPHS Ph.D. Thesis
Nancy Valree Phillips 1980 88 p
Avail: Univ. Microfilms Order No. 8110191

For a finite network G = (N,E) with arc lengths representing travel distance, the m-center problem is to locate m or fewer facilities at nodes of a network in order to minimize the maximum distance from each node to the closest facility. The m-center problem in general networks is investigated using chordal graphs by finding the smallest radius r such that a minimum dominating set (MDS) of G(r) has cardinality m or less. Polynomial-time algorithms are developed here for finding an MDS of a chordal graph. Computational studies are done to estimate the percentage of graphs (G(r) which are chordal out of all G(r)s generated by a network, the percentage of m-center solutions which occur in a chordal G(r), and the percentage of nonchordal G(r)s for which the chordal algorithm finds a minimum dominating set. It is shown that Balinski's reduction method always finds an optimal m-center solution for tree graphs. The chordal algorithm, teamed with a heuristic, is applied to the problem of locating garbage facilities in upper Oconee County, South Carolina. Some results about spanning trees and augmenting solutions for general graphs are presented. Dissert. Abstr.

N81-24798 Notre Dame Univ., Ind.
THE PENALTY METHOD FOR MILDLY NONLINEAR BOUNDARY VALUE PROBLEMS ON DOMAINS WITH CURVED BOUNDARY Ph.D. Thesis
Padraig Seosamh OBrian 1981 108 p
Avail: Univ. Microfilms Order No. 8109115

Quasioptimal error estimates are derived for the solution of mildly nonlinear boundary value problems on domains with curved boundary. The use of error estimates for the penalty method of solving linear elliptic boundary value problems is extended to mildly nonlinear boundary value problems. Dissert. Abstr.

N81-24799 Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
AN ANNOTATED BIBLIOGRAPHY OF WORKS ON BABYLONIAN MATHEMATICS
Joeran Friberg Sep. 1980 19 p
(CTH-MATH-1980-14) Avail: Issuing Activity

The bibliography (over 100 items) is arranged in chronological order and contains general reference works, personalia, source materials, and histories in addition to journal articles. Prebabylonia mathematics and metrology in the Middle East are included. Topics listed include linear and quadratic equations, factorization, multiplication, reciprocals and squares.
Author (ESA)

N81-24800*# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Mathematical Sciences.
AN ADAPTIVE FINITE ELEMENT METHOD FOR INITIAL - BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS Interim Report
Stephen F. Davis and Joseph E. Flaherty Mar. 1981 47 p
(Contract NAS1-15810; Grant AF-AFOSR-0192-80; AF Proj. 9749)
(NASA-CR-164233; AD-A098138; AFOSR-81-0376TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

A finite element method is developed to solve initial-boundary value problems for vector systems of partial differential equations in one space dimension and time. The method automatically adapts the computational mesh as the solution progresses in time and is thus able to follow and resolve relatively sharp transitions such as mild boundary layers, shock layers, or wave fronts. This permits an accurate solution to be calculated with fewer mesh points than would be necessary with a uniform mesh. The overall method contains two parts, a solution algorithm and a mesh selection algorithm. The solution algorithm is a finite element-Galerkin method on trapezoidal space-time elements, using either piecewise linear or cubic polynomial approximations and the mesh selection algorithm builds upon similar work for variable knot spline interpolation. A computer code implementing these algorithms has been written and applied to a number of problems. These computations confirm that the theoretical error estimates are attained and demonstrate the utility of variable mesh methods for partial differential equations.
Author (GRA)

N81-24801*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PRINCIPAL NORMAL CURVATURE OF SURFACES
Richard F. Schmidt Mar. 1981 28 p refs Submitted for publication
(NASA-TM-82102) Avail: NTIS HC A03/MF A01 CSCL 12A

Certain principal normal curvatures of differential geometry were developed for use in curvature matrices associated with the asymptotic solution of electromagnetic diffraction problems. The effort is directed toward microwave antenna simulations and high speed digital computer analysis of radiometric instruments used to obtain soil moisture, sea state, salinity and temperature data. It is shown that the methods used to develop the principal normal curvatures for paraboloid, hyperboloid, ellipsoid, sphere, and cone can be applied to other radiometer geometries such as the parabolic torus, even though the surface parameterizations are different. It is concluded that deployable offset geometries, distorted by rotational forces and solar loads may be analyzed by similar means given a suitable surface description. A.R.H.

N81-24802# Yale Univ., New Haven, Conn. Dept. of Computer Science.
ON SOME TRENDS IN ELLIPTIC PROBLEM SOLVERS
S. C. Eisenstat and M. H. Schultz Feb. 1981 17 p refs
(Contract N00014-76-C-0277)
(AD-A098225; TR-194/81) Avail: NTIS HC A02/MF A01 CSCL 12/1

Elliptic boundary value problems are at the core of many systems of partial differential equations occurring in mechanics. Examples of applications include fluid dynamics, semiconductor device modelling, and structural analysis. Thus, it is important to have efficient and robust elliptic problem solvers. In this paper we discuss some of the issues involved in the design of a high-technology elliptic problem solver. In particular, we will concentrate our attention on the design of a modular, heterogeneous multi-processor elliptic problem solver consisting of a host computer and one or more peripheral processors. GRA

N81-24803# Yale Univ., New Haven, Conn. Dept. of Computer Science.

EFFICIENT IMPLEMENTATION OF A CLASS OF PRECONDITIONED CONJUGATE GRADIENT METHODS

Stanley C. Eisenstat Aug. 1980 9 p refs

(Contract N00014-76-C-0277)

(AD-A098233; RR-185) Avail: NTIS HC A02/MF A01 CSCL 12/1

The preconditioned conjugate gradient (PCG) method is an effective means for solving systems of linear equations where the coefficient matrix is symmetric and positive definite. The incomplete LDL(t) factorizations are a widely used class of preconditionings, including the SSOR, Dupont-Kendall-Rachford, Generalized SSOR, ICCG(0), and MICCG(0) preconditionings. The efficient implementation of PCG with a preconditioning from this class is discussed. Author (GRA)

N81-24804# Florida State Univ., Tallahassee. Dept. of Statistics.

LINEAR LEAST SQUARES ESTIMATES AND NONLINEAR MEANS

Roger L. Berger and Naftali A. Langberg Mar. 1981 15 p refs

(Contract DAAG29-79-C-0158; Grant AF-AFOSR-3678-78)

(AD-A098169; FSU-Statistics-M-573; TR-D-50-ARO; ARO-16713.15-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

The consistency and asymptotic normality of a linear least squares estimate of the form (X,X)(bar)X,Y when the mean is not (X)(Beta) is investigated in this paper. The least squares estimate is a consistent estimate of the best linear approximation of the true mean function for the design chosen. The asymptotic normality of the least squares estimate depends on the design and the asymptotic mean may not be the best linear approximation of the true mean function. Author (GRA)

N81-24805# Cornell Univ., Ithaca, N. Y. Dept. of Computer Science.

POLYNOMIAL-TIME ALGORITHMS FOR PERMUTATION GROUPS

Merrick Furst (Carnegie-Mellon Univ., Pittsburgh), John Hopcroft, and Eugene Luks (Bucknell Univ., Lewisburg, Pa.) Oct. 1980 19 p refs

(Contract N00014-76-C-0018; Grant NSF SPI-79-14527)

(AD-A097825; CU-CSD-TR-80-442) Avail: NTIS HC A02/MF A01 CSCL 12/1

A permutation group on n letters may always be represented by a small set of generators, even though its size may be exponential in n. We show that it is practical to use such a representation since many problems such as membership testing, equality testing, and inclusion testing can be described in polynomial time. In addition, we demonstrate that the normal closure of a subgroup can be computed in polynomial time, and that this procedure can be used to test a group for solvability. We also describe an approach to computing the intersection of two groups. The procedures and techniques have wide applicability and have recently been used to improve many graph isomorphism algorithms. Author (GRA)

N81-24806# Cincinnati Univ., Ohio. Dept. of Mechanical and Industrial Engineering.

VALIDATION OF FINITE SEGMENT CABLE MODELS Technical Report, 1 Oct. 1979 - 15 Apr. 1981

Ronald L. Huston and James W. Kamman 15 Apr. 1981 34 p refs

(Contract N00014-76-C-0139)

(AD-A097749; UC-MIE-041581-11-ONR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Analytical and experimental data is presented validating a finite segment cable model. The model consists of a series of pin-connected rigid rods which may have different lengths, diameters, and masses. The model is capable of simulating large, three-dimensional motion of flexible cables. Its principal areas of appliction are expected to be with the simulation of long, heavy, towing and hoisting cables. Author (GRA)

N81-24807# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.

A SCATTERING FRAMEWORK FOR DECENTRALIZED ESTIMATION PROBLEMS

Bernard C. Levy, David A. Castanon, George C. Verghese, and Alan S. Willsky Mar. 1981 58 p

(Contract N00014-77-C-0532; Grant NSF ECS-80-12608; NR Proj. 041-519)

(AD-A098117; LIDS-P-1075) Avail: NTIS HC A04/MF A01 CSCL 12/1

In this paper we develop a comprehensive framework for the study of decentralized estimation problems. This approach imbeds a decentralized estimation problem into an equivalent scattering problem, and makes use of the superposition principle to relate local and centralized estimates. Some decentralized filtering and smoothing algorithms are obtained for a simple estimation structure consisting of a central processor and of two local processors. The case when the local processors exchange some information is considered, as well as the case when the local state-space models differ from the central one. Author (GRA)

N81-24808# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.

UNDESIRABLE PERFORMANCE CHARACTERISTICS OF EXISTING MODEL-REFERENCE ADAPTIVE CONTROL ALGORITHMS Interim Report

C. Rohrs, L. Valavani, M. Athans, and G. Stein 15 Mar. 1981 11 p refs Proposed for presentation at the 20th IEEE Conf. on Decision and Control, San Diego, Calif., Dec. 1981

(Grant AF-AFOSR-3281-77; AF Proj. 2304)

(AD-A098099; LIDS-P-1076; AFOSR-81-0389TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The full paper will describe recent theoretical results, backed up by digital computer simulation studies, that relate to the performance of several adaptive control algorithms that are based on model reference techniques. Special emphasis was placed upon the transient performance of these algorithms and the implications upon the bandwidth of the closed-loop adaptive system. The conclusions are as follows: (1) During the transient phase of the adaptation procedure, the control signal is characterized by excessive high frequency content. Novel analytical based upon stability theory can be used to predict this high frequency oscillatory behavior, which depends both upon the amplitude and frequency of the reference input. (2) During the transient adaptation phase the excessive control loop bandwidth is detrimental to system performance, because it can excite unmodeled high-frequency dynamics and lead to instability. (3) Similar effects can occur in the presence of stochastic inputs (plant noise and measurement noise). The analytical techniques that have been developed are constructive, so that modifications to the existing algorithms are suggested to overcome the practical shortcomings of the existing algorithms. Full details will be given in the conference paper. Author (GRA)

N81-24809# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

THE CURVE OF LEAST ENERGY

B. K. P. Horn Jan. 1981 37 p refs

(Contract N00014-80-C-0505)

(AD-A098054; AI-M-612) Avail: NTIS HC A03/MF A01 CSCL 12/1

Here we search for the curve which has the smallest integral of the square of curvature, while passing through two given points with given orientation. This is the true shape of a spline used in lofting. In computer-aided design, curves have been sought which maximize 'smoothness'. The curve discussed here is the one arising in this way from a commonly used measure of smoothness. The human visual system may use such a curve when it constructs a subjective contour. Author (GRA)

N81-24810# Ohio State Univ., Columbus. Dept. of Statistics.

SOME TESTS OF RANDOMNESS WITH APPLICATIONS

J. S. Rustagi Feb. 1981 38 p refs

(Contract N00014-78-C-0543; NR Proj. 042-403)

(AD-A098118; TR-222) Avail: NTIS HC A03/MF A01 CSCL 12/1

A brief survey of tests of randomness is made. Commonly used tests of randomness for samples, for generated random numbers, for time series and for discrete random events are

discussed. Applications are made to coal mining disasters in England, and present lottery games. Author (GRA)

N81-24811# Naval Postgraduate School, Monterey, Calif. Dept. of Mathematics.
SMOOTH INTERPOLATION OF SCATTERED DATA BY LOCAL THIN PLATE SPLINES Technical Report, Jan. 1979 - Mar. 1981
Richard Franke 26 Mar. 1981 30 p refs
(AD-A098232; NPS53-81-002) Avail: NTIS HC A03/MF A01 CSCL 12/1

An algorithm and the corresponding computer program for solution of the scattered data interpolation problem are described. Given points (x sub k, y sub k, f sub k), k = 1, ..., N a locally defined function F(x,y) which has the property F(x sub k, y sub k) = f sub k, k = 1, ..., N is constructed. The algorithm is based on a weighted sum of locally defined thin plate splines, and yields an interpolation function which is differentiable. The program is available from the author. Author (GRA)

N81-24812# Los Alamos Scientific Lab., N. Mex.
REVIEW OF CHARACTERISTIC METHODS USED TO SOLVE THE LINEAR TRANSPORT EQUATION
R. E. Alcouffe and Edward W. Larsen 1981 14 p refs Presented at ANS/ENS Joint Topical Meeting, Mathematical Methods in Nucl. Eng., Munich, 26-29 Apr. 1981
(Contract W-7405-eng-36)
(LA-UR-81-136; CONF-810415-4) Avail: NTIS HC A02/MF A01

Characteristic methods used to solve the linear transport equation are reviewed. The methods of solution distinguish themselves in how the characteristics used for computation are selected and how the source term is approximated. Criteria upon which a production method should be based are recommended. DOE

N81-24813# National Aerospace Lab., Amsterdam (Netherlands).
PRACTICAL CONSIDERATIONS ABOUT THE RELATIONSHIP BETWEEN APPLIED MATHEMATICS AND INFORMATION SCIENCE
W. Loeve 12 Feb. 1980 22 p refs In DUTCH; ENGLISH summary Presented at Math. Inst., Groningen, Netherlands, 12 Feb. 1980
(NLR-MP-80007-U) Avail: NTIS HC A02/MF A01

Computer modelling as an aspect of applied mathematics is discussed. The integration of this type of research with on information systems is examined, with implications for the applied mathematician. Author (ESA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N81-24814 Florida State Univ., Tallahassee.
BAYESIAN SOLUTIONS TO SOME CLASSICAL PROBLEMS OF STATISTICS Ph.D. Thesis
Carlos Alberto deBraganca Pereira 1980 113 p
Avail: Univ. Microfilms Order No. 8108380

The theory of conditional independence is explained and the relations between ancillarity, sufficiency, and statistical independence are discussed. Related concepts like specific sufficiency, bounded completeness, and splitting sets are also studied. In the case of analyzing categorical data with missing entries, a suitably chosen prior for the frequency parameters can streamline the analysis in the presence of missing entries due to non-response or other causes. The two cases where the data follow the Multinomial or the Multivariate Hypergeometric model are treated separately. In the first case it is adequate to restrict the prior (for the cell probabilities) to the class of Dirichlet distribution. In the Hypergeometric case, it is convenient to select a prior (for the cell population frequencies) from the class of Dirichlet-Multinomial (DM) distributions. The DM distributions are studied. Dissert. Abstr.

N81-24815 Minnesota Univ., Minneapolis.
CONDITIONAL LIKELIHOOD INFERENCE Ph.D. Thesis
Patricia Louise Meller Grambsch 1980 113 p
Avail: Univ. Microfilms Order No. 8109434

Asymptotic likelihood inference conditional on ancillary statistics is considered in two contexts. The first involves a scalar parameter and a sequential sampling scheme in which iid observations are sampled until the observed Fisher information exceeds a target value. It is proved that the theorems for fixed sample size conditional likelihood inference are directly applicable to the sequential sampling scheme for location families. The fixed sample size approximate ancillary statistic for two-dimensional curved exponential families is shown to be ancillary in the sequential sampling scheme and a heuristic argument and evidence from Monte Carlo simulations suggest the applicability of the fixed sample size conditional likelihood inference theorems to these families as well. The distribution of the sequential sample size is shown to be asymptotically normal. The second context involves a fixed sample size sampling scheme and a multidimensional parameter. It is shown that, conditional on an appropriate ancillary statistic, the maximum likelihood estimate is asymptotically standard multivariate normal when standardized by means of the observed Fisher information matrix. Dissert. Abstr.

N81-24816 Minnesota Univ., Minneapolis.
ANALYSIS OF CATEGORICAL DATA WITH ORDERED CATEGORIES Ph.D. Thesis
Jane-Lan Christy Chuang 1980 173 p
Avail: Univ. Microfilms Order No. 8109405

In this thesis, multiplicative-interaction (M-I) models for multidimensional contingency tables are introduced and studied. These models complement the usual loglinear models by modeling the interactions as products of row and column terms. The methods for contingency tables are extended to apply to logic models for the explanatory-response situations. Estimates of parameter for all models are derived by both maximum likelihood and Bayesian methods. Special emphasis is placed on the estimation of the underlying scores for the levels of the categorical variables. Asymptotic properties of the maximum likelihood estimates and the associated test statistics are discussed. A version of the EM algorithn is used to obtain estimates for prior variance components in the Bayesian formulation. The techniques are illustrated by application to several examples. Dissert. Abstr.

N81-24817 Illinois Univ. at Urbana-Champaign.
STABILITY OF CANONICAL WEIGHTS: A MONTE CARLO STUDY Ph.D. Thesis
Farouk Fayez Saad 1980 57 p
Avail: Univ. Microfilms Order No. 8108647

The stability of the canonical weights and the canonical subspace was investigated. This investigation was carried out over four different population structures encompassing five different battery sizes. Two important and concrete notions were fully treated, the Tucker canonical subspace and its stability, and the derivation for the variance of the first canonical weight of the one-factor model. The exact and asymptotic distributions were derived for the variance of the first canonical weight of the one-factor model. Variances for each one of the sample sizes were computed and compared with the Monte Carlo results. Dissert. Abstr.

N81-24818 Texas Univ. at Arlington.
COMPUTATIONAL PROCEDURES FOR OBTAINING LEAST ABSOLUTE VALUE ESTIMATES Ph.D. Thesis
Mabel Kar-Ming Tam Kung 1980 150 p
Avail: Univ. Microfilms Order No.8109197

Specialized algorithms are developed for obtaining least absolute value estimates in a variety of statistical models. A computational study was conducted comparing algorithms on a variety of computers. Applications in data analysis, goal programming, and numerical analysis are considered. Dissert. Abstr.

N81-24819 Stanford Univ., Calif.
REPEATED LIKELIHOOD RATIO TESTS FOR CURVED EXPONENTIAL FAMILIES Ph.D. Thesis
Steven Paul Lalley 1981 122 p

Avail: Univ. Microfilms Order No. 8108961

A class of repeated significance tests for curved hypotheses in multiparameter exponential families is studied and asymptotic formulae for the significance levels of such tests are obtained. Special attention is given the important case of comparing Bernoulli success probabilities. The renewal theory relevant to the stopping rules involved in the test procedures is also discussed. Dissert. Abstr.

N81-24820 Stanford Univ., Calif.
AN ADAPTIVE R-ESTIMATE Ph.D. Thesis
Michael Lee Cohen 1981 65 p
Avail: Univ. Microfilms Order No. 8108906

A procedure which uses the entire data set to estimate the score function of the locally most powerful rank test is proposed. Using nearest neighbor density estimation methods, an estimate of the score function for the asymptotically most powerful grouped rank test is constructed. This function is itself a step function approximation to the score function for the locally most powerful rank test. Large sample distribution and optimality results are obtained for both the adaptive rank test and the corresponding R-estimate of location. Small sample Monte-Carlo results are provided. Dissert. Abstr.

N81-24821 California Univ., Santa Barbara.
DIRICHLET DISTRIBUTIONS-TYPE 2 FOR RANKING AND SELECTION PROBLEMS Ph.D. Thesis
Albert Han-Chu Liu 1980 161 p
Avail: Univ. Microfilms Order No. 8108367

A mixed-limits Dirichlet-Type 2 integral called the L function is studied. This integral is exactly equal to a certain complicated negative multinomial sum. This probability interpretation is proved and the recursive formulae to make the tables for the applications of some ranking and selection problems are developed. First, the selection of the t smallest variance of k normal populations is considered. Second, a different selection goal, namely, selecting a subset of the smallest possible fixed size is (t < or = s < or = k) that will contain the t smallest variances of k normal populations based on any given common sample size from each of the k populations is studied. Finally, the problem of selecting a subset of size at least t(> or = 1) which excludes all non-t-best populations, and the problem of selecting a subset (of random size) containing the t best populations is discussed. The problem of selecting a subset including all the populations better than the t best is also considered. Dissert. Abstr.

N81-24822 Washington Univ., Seattle.
A GOODNESS-OF-FIT STATISTIC FOR BINARY LOGISTIC REGRESSION Ph.D. Thesis
William Alfred Halteman 1980 91 p
Avail: Univ. Microfilms Order No. 8109734

A statistic to assess the goodness of fit for binary logistic regression is proposed. The statistic is a quadratic form in observed counts minus expected counts. Parameters are estimated using maximum likelihood techniques. The statistic is shown to have a limiting chi-squared distribution with k-1 degrees of freedom regardless of the number of parameters estimated. Grouping rules based on the estimated parameters are shown to have no effect on the limiting distribution. Similation studies indicate a reasonable approximation to the limiting distribution with sample sizes of 50 or 100. Three different grouping rules are compared and yield similar results. Power studies were performed and the statistic demonstrates adequate power over a wide range of alternatives. Finally, the statistic is compared to two other goodness-of-fit statistics and is shown to have greater power for all of the alternatives considered. Dissert. Abstr.

N81-24823 Washington Univ., Seattle.
PROPORTIONAL INTENSITY MODELS FOR MULTIPLE EVENT TIMES Ph.D. Thesis
Barbara J. Williams 1980 212 p
Avail: Univ. Microfilms Order No. 8109787

The general problem of formulating models for representing and analyzing multiple event time data with covariates is addressed. These data are modeled as realizations of a joint counting-covariate process (N,Z) over a finite time interval (a,b). Since outcomes are obtained over time, the covariates Z may be constant, time dependent, and in addition, dependent on the realization of (N,X)(history dependent). Dissert. Abstr.

N81-24824 Minnesota Univ., Minneapolis.
TOPICS IN STOCHASTIC DIFFERENTIAL EQUATIONS AND IN THE THEORY OF TWO-PARAMETER GAUSSIAN PROCESSES Ph.D. Thesis
Clayton Charles Bromley 1980 169 p
Avail: Univ. Microfilms Order No. 8109395

The factorization theory of self-adjoint operators on Hilbert space is adapted to provide a four-fold factorization of the S-operator naturally defined on the common reproducing kernel Hilbert space of the two measures. Necessary and sufficient conditions for the existence of strongly nonanticipative representations are then expressed in terms of this factorization. The notion of weak solution up to explosion time can be developed for stochastic differential equations having continuous coefficients not satisfying any boundedness or growth condition. It is necessary to consider an enlarged path space and to interpret the original equation as being solved only up to an explosion time, that is, a stopping time implicitly defined by the coefficients of the differential equation beyond which the paths of the solution process cannot be continuously extended. The weak solution up to explosion time is then obtained on this enlarged path space as a projective limit of a sequence of probability measures. Dissert. Abstr.

N81-24825 California Univ., Riverside.
FUNCTIONAL EQUATIONS ASSOCIATED WITH MARKOV MODELS FOR LABOR MOBILITY AND WITH DISTRIBUTION THEORY Ph.D. Thesis
Kanapathipillai Thirugnanasambanthan 1980 74 p
Avail: Univ. Microfilms Order No. 8110287

A stochastic model for occupational mobility treating the time interval between moves as discrete is proposed. This model is analyzed using functional equations. Characterizations of the Pareto and Weibull distributions by successive order statistics are stated and proved using functional equations. Dissert. Abstr.

N81-24826 Missouri Univ. -Columbia.
STATISTICAL INFERENCE ON THE LOG-ZERO-POISSON DISTRIBUTION Ph.D. Thesis
Magdy Sayed Khedr 1980 131 p
Avail: Univ. Microfilms Order No. 8108813

A discrete distribution called the log-zero-Poisson distribution was recommended by Katti as an alternative to the negative binomial, the Neyman type A distributions, and other distributions, usually called contagious distributions. A major problem in the use of this and all other contagious distributions is the difficulty of obtaining the maximum likelihood estimates. The use of the moment estimator is compared to the ad hoc estimator proposed by Huque both as an approximation to the maximum likelihood estimator and as initial estimates in solving likelihood equations through an iterative scheme. Dissert. Abstr.

N81-24827# Tel-Aviv Univ. (Israel). Dept. of Applied Mathematics.
THE STABILITY OF PSEUDOSPECTRAL-CHEBYSHEV METHODS Interim Report
David Gottlieb 1981 30 p
(Grant AF-AFOSR-3405-77; AF Proj. 2304)
(AD-A097989; AFOSR-81-0390TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

The stability of pseudospectral-Chebyshev methods is demonstrated for parabolic and hyperbolic problems with variable coefficients. The choice of collocation points is discussed. Numerical examples are given for the case of variable-coefficient hyperbolic equations. Author (GRA)

N81-24828# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
OPTIMAL BANG-BANG CONTROL OF PARTIALLY OBSERVABLE STOCHASTIC SYSTEMS
Y. Yavin and G. Reuter Aug. 1980 26 p refs Sponsored in part by Control Data Corp.
(CSIR-TWISK-164) Avail: NTIS HC A03/MF A01

A class of nonlinear controlled stochastic systems is introduced; the class of admissible controls consisting of partially

observable control laws that are measurable and bounded. Sufficient conditions are derived for admissible optimal control laws to maximize the probability that at a random time tau the state will be in a given set. These conditions are given by a set of coupled nonlinear partial differential equations. An example is solved numerically. Finally, the problem of the best linear controller is discussed. M.G.

N81-24829*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

CALCULATION OF POWER SPECTRUMS FROM DIGITAL TIME SERIES WITH MISSING DATA POINTS

Charles W. Murray, Jr. Dec. 1980 66 p refs

(NASA-TM-82016) Avail: NTIS HC A04/MF A01 CSCL 12A

Two algorithms are developed for calculating power spectrums from the autocorrelation function when there are missing data points in the time series. Both methods use an average sampling interval to compute lagged products. One method, the correlation function power spectrum, takes the discrete Fourier transform of the lagged products directly to obtain the spectrum, while the other, the modified Blackman-Tukey power spectrum, takes the Fourier transform of the mean lagged products. Both techniques require fewer calculations than other procedures since only 50% to 80% of the maximum lags need be calculated. The algorithms are compared with the Fourier transform power spectrum and two least squares procedures (all for an arbitrary data spacing). Examples are given showing recovery of frequency components from simulated periodic data where portions of the time series are missing and random noise has been added to both the time points and to values of the function. In addition the methods are compared using real data. All procedures performed equally well in detecting periodicities in the data. M.G.

N81-24830# Texas A&M Univ., College Station. Inst. of Statistics.

A GENERALIZED APPROACH TO THE TWO SAMPLE PROBLEM: THE QUANTILE APPROACH

Thomas Jeffery Prihoda Apr. 1981 138 p refs

(Contract DAAG29-80-C-0070)

(AD-A098240; TR-B-5; ARO-16992.5-M) Avail: NTIS HC A07/MF A01 CSCL 12/1

Parzen (1979) suggests a location and scale model for the quantile function (inverse distribution function) of a random variable. We extend this model to the two sample and k-sample problems and some results are given which, when fully implemented, will yield more general solutions in the analysis of variance. Most of the work here concerns the location and scale model suggested by Parzen (1980) for the two sample problem for testing the equality of two distribution functions versus local alternatives. We implement this model (its test and estimators) for seven underlying densities. We then provide criteria for choosing or determining whether an underlying density models the differences of the two samples adequately. These criteria allow one to choose the best of several underlying densities for the data. We illustrate these techniques by analyzing data sets from the literature and making comparisons with other authors' techniques. We also show how the Parzen (1980) model is related to many of the techniques developed for studying differences of two samples over the past 50 years. We suggest extensions of Parzen's model. Finally, we give a few simulated examples and suggest what type of simulation study is needed to further define the usefulness of the various models presented in the dissertation. Author (GRA)

N81-24831# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.

DISCRETE-TIME STOCHASTIC CONTROL OF HYBRID SYSTEMS

D. A. Castanon, H. J. Chizeck, and A. S. Willsky May 1980 6 p refs

(Grant NGL-22-009-124; Contracts N00014-77-C-0224; ET-76-C-01-2295)

(NASA-CR-164261; AD-A098226; LIDS-P-998) Avail: NTIS HC A02/MF A01 CSCL 14/4

A simple class of discrete-time nonlinear stochastic control problems with quadratic costs for linear systems with randomly-jumping state-dependent parameters are solved using dynamic programming. The resulting controllers exhibit 'active hedging' properties. GRA

N81-24832# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Electrical Computer and Systems Engineering.

FURTHER RESULTS ON TEXTURE DISCRIMINATION BASED UPON AN ASSUMED STOCHASTIC TEXTURE MODEL Final Technical Report

Acie L. Vickers and James W. Modestino Mar. 1981 40 p refs

(Contract F30602-78-C-0083; AF Proj. 4594)

(AD-A098106; RADC-TR-81-14) Avail: NTIS HC A03/MF A01 CSCL 12/1

Further results of a new approach to texture discrimination are described. The approach is based upon an assumed stochastic model for texture in imagery and is an approximation to the statistically optimum maximum likelihood classifier. A method for estimating the structural parameters of the assumed stochastic texture model for each known texture class is described, and experimental results are provided which demonstrate the efficacy of this approach with simulated and real world texture data. Author (GRA)

N81-24833# Pennsylvania Univ., Philadelphia. Inst. for Statistics and Applications.

MULTIVARIATE DISTRIBUTIONS IN RELIABILITY THEORY AND LIFE TESTING

Henry W. Block (Sao Paulo Univ.) and Thomas H. Savits Apr. 1981 30 p refs

(Contract N00014-76-C-0839; Grant NSF MCS-77-01458)

(AD-A098152; TR-81-13) Avail: NTIS HC A03/MF A01 CSCL 12/1

Multivariate parametric distributions which are of interest in reliability theory and life testing are discussed. These include distributions with exponential, Weibull and gamma univariate marginal distributions. Other distributions of interest are the multivariate nonparametric distributions whose marginals have increasing failure rates (IFR), increasing failure rate averages (IFRA), are new better than used (NBU) or new better than used in expectation (NBUE). Also mentioned are univariate and multivariate processes which have associated with the distributions in the various nonparametric classes mentioned above. Author (GRA)

N81-24834# Pennsylvania Univ., Philadelphia. Dept. of Mathematics and Statistics.

CHARACTERIZATIONS OF GENERALIZED MARKOV-POLYA AND GENERALIZED POLYA-EGGENBERGER DISTRIBUTIONS Interim Report

K. G. Janardan (Sangamon State Univ., Springfield, Ill.) and B. Raja Rao Feb. 1981 16 p refs

(Contract F49620-79-C-0016; AF Proj. 2304)

(AD-A098072; TR-81-03; AFOSR-81-0386TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

A discrete model is considered where the original observation is subjected to partial destruction according to the generalized Markov-Polya damage model. A characterization of the generalized Polya-Eggenberger distribution is given in the context of the Rao-Rubin condition. Several other characterization theorems are also proved concerning these probability distributions. Author (GRA)

N81-24835# Pennsylvania Univ., Philadelphia. Inst. for Satistics and Applications.

NEARLY EFFICIENT ESTIMATORS BASED ON ORDER STATISTICS Interim Report

Takeaki Kariya (Hitotsubashi Univ.), Bimal K. Sinha (Indian Statistical Inst.), and Kasala Subramanyam Feb. 1981 13 p refs

(Contract F49620-79-C-0161; AF Proj. 2304)

(AD-A098074; TR-81-05; AFOSR-81-0388TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this note, based on 3 or 5 order statistics out of n order statistics, nearly asymptotically efficient estimators are obtained for Cauchy and logistic distributions as well as normal distributions. Author (GRA)

N81-24836# Pennsylvania Univ., Philadelphia. Inst. for Statistics and Applications.
CHARACTERIZATION THEOREMS INVOLVING THE GENERALIZED MARKOV-POLYA DAMAGE MODEL Interim Report
B. Raja Rao (Sangamon State Univ., Springfield, Ill.) and K. G. Janardan Feb. 1981 19 p refs
(Contract F49620-79-C-0161; AF Proj. 2304)
(AD-A098073; TR-81-04; AFOSR-81-0387TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

In the present paper, certain random damage models are examined, such as the Generalized Markov-Polya and the Quasi-Binomial, in which an integer-valued random variable N is reduced to N(A). If N(B) is the missing part, where N = N(A) + N(B), the covariance between N(A) and N(B) is obtained for some general classes of distributions, such as the G.P.S.D. and M.P.S.D. for the random variable N. A characterization theorem is proved that under the generalized Markov-Polya damage model, the random variables N(A) and N(B) are independent if, and only if, N has the Generalized Polya-Eggenberger distribution. This generalizes the corresponding result for the Quasi-Binomial damage model and the generalized Poisson distribution. Finally, some interesting identities are obtained using the independence property and the covariance formulas between the numbers N(A) and N(B). Author (GRA)

N81-24837# North Carolina Univ. at Chapel Hill. Inst. of Statistics.
ROBUST ESTIMATION IN THE HETEROSCEDASTIC LINEAR MODEL WHEN THERE ARE MANY PARAMETERS Interim Report
R. J. Carroll Dec. 1980 17 p refs
(Grant AF-AFOSR-0080-80; AF Proj. 2304)
(AD-A098076; MIMEO-SER-1321; AFOSR-81-0383TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

We study estimation of regression parameters in heteroscedastic linear models when the number of parameters is large. The results generalize work of Huber (1973), Yohai and Maronna (1979), and Ruppert and Carroll (1989). Author (GRA)

N81-24838# Illinois Univ. at Urbana. Computer-Based Education Research Lab.
SOME COMPARISONS OF FOUR ORDER-ANALYTIC METHODS AND FACTOR ANALYSIS FOR ASSESSING DIMENSIONALITY
Steven L. Wise Feb. 1981 40 p refs
(Contract N00014-79-C-0752; NR Proj. 150-415; RR0420401)
(AD-A097714; RR-81-2) Avail: NTIS HC A03/MF A01 CSCL 12/1

Current latent-trait methods require that the latent space underlying a group's test performance be unidimensional. However, many tests yield multidimensional data, implying that more than one latent trait would be necessary to account for test performance. A possible solution to this problem of multidimensionality would be to isolate unidimensional subsets of items from the total set of test items and use item response theory with each subset. While factor analysis is the most commonly proposed procedure for determining dimensionality, a recently developed procedure called order analysis may also prove to be useful for isolating unidimensional item sets. GRA

N81-24839# Naval Underwater Systems Center, New London, Conn. Information Services Dept.
LINEAR CHEBYSHEV COMPLEX FUNCTION APPROXIMATION
Roy L. Streit and Albert H. Nuttall 26 Feb. 1981 50 p refs (ZR0000101)
(AD-A098309; NUSC-TR-6403) Avail: NTIS HC A03/MF A01 CSCL 12/1

A new computational technique is described for the Chebyshev, or minimax, approximation of a given complex valued function by means of linear combinations of given complex valued basis functions. The domain of definition of all functions can be any finite set whatever. Neither the basis functions nor the function approximated need satisfy any special hypotheses beyond the requirement that they be defined on a common domain. Theoretical upper and lower bounds on the accuracy of the computed Chebyshev error are derived. These bounds permit both a priori and a posteriori error assessments. Efforts to extend the method to functions whose domain of definition is a continuum are discussed. Numerical examples and a FORTRAN program listing are included. An application is presented involving re-shading a 50 element antenna array to minimize the effects of a 10% element failure rate, while maintaining full steering capability and mainlobe beamwidth. Author (GRA)

N81-24840# Iowa Univ., Iowa City. Div. of Educational Psychology.
MULTIATTRIBUTE FIXED-STATE UTILITY ASSESSMENT Technical Report, 1 Jul. - 31 Dec. 1980
David L. Libby and Melvin R. Novick 27 Mar. 1981 206 p refs
(Contract N00014-77-C-0428; Grant NSF SED-80-06357; RR0420401; NR Proj. 150-404)
(AD-A098230; TR-81-4) Avail: NTIS HC A10/MF A01 CSCL 12/1

This paper is concerned with the assessment of utility functions for multiple attributes. The literature on utility assessment, multidimensional scaling, conjoint measurement, and conditional expected utility theory is reviewed. A procedure for utility assessment is presented using as models cumulative multivariate distribution functions. Author (GRA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N81-24841 Stanford Univ., Calif.
OPTIMIZATION OF UNCONSTRAINED FUNCTIONS WITH SPARSE HESSIAN MATRICES Ph.D. Thesis
Mukund Narain Thapa 1981 184 p
Avail: Univ. Microfilms Order No. 8109005

Algorithms for solving large unconstrained optimization problems that have a sparse Hessian matrix are developed and analyzed. Newton-type methods and quasi-Newton-type methods are successful for solving dense unconstrained optimization problems. Newton-type methods require knowledge of the Hessian matrix at each iteration. Often it is difficult, if not impossible, to obtain an analytic representation of the Hessian matrix. Determining the Hessian matrix by the standard method of finite differences is costly in terms of gradient evaluations for large problems. Automatic procedures that reduce the number of gradient evaluations by exploiting sparsity are examined and a new procedure is suggested. Once a sparse approximation to the Hessian matrix is obtained, there still remains the problem of solving a sparse linear system of equations at each iteration. One way of approaching this problem is to ignore fill-in in a systematic manner. Such techniques are called partial factorization methods. Dissert. Abstr.

N81-24842 Stanford Univ., Calif.
SOLUTION METHODS FOR STOCHASTIC DYNAMIC LINEAR PROGRAMS Ph.D. Thesis
John Roberts Birge 1981 138 p
Avail: Univ. Microfilms Order No. 8108894

The methods presented for solving these programs are based upon three major large-scale optimization techniques: decomposition; partitioning; and basis factorization. The first two methods are basically dynamic programming approaches in which the state space is locally approximated. The structure of the program then allows for additional efficiency to be gained in following procedures toward optimality. The third method exploits the repeated block structure of the entire program in reducing the storage and computational requirements of the revised simplex method. Computational experience with these methods was restricted to a variety of small problems taken from examples in optimal control, production and energy. The results on these small examples showed that some computational advantage may result from these techniques. Dissert. Abstr.

N81-24843 Stanford Univ., Calif.
AN ADDITIVE ALGORITHM FOR THE MULTIPLE CHOICE

INTEGER PROGRAM Ph.D. Thesis
James Carl Bean 1981 128 p
Avail: Univ. Microfilms Order No. 8108892

The problem dealt with is the Multiple Choice Integer Program (MCIP), a special case of the integer linear programming problem with binary variables. In this program the variables are partitioned (using the classical definition of 'partition'). Exactly one variable in each partitioning set has the value one in any feasible solution and all other variables have the value zero. The problem also allows any additional constraints that can be expressed as linear inequalities. The objective is to choose elements from these sets so as to minimize cost. Chapter 2 discusses the history of this problem and solution techniques developed for it. Chapter 3 presents discussion of additive type algorithms and the algorithm proposed. Applications of this algorithm follow in Chapter 4. In Chapter 5, it is proven that the algorithm will correctly solve any problem of this type in finite time. In Chapter 6, Geoffrion's surrogate constraints are revised to take advantage of the additional structure in this problem. A heuristic version of the algorithm is developed in Chapter 7 that has guaranteed accuracy (upper bound on percent error) of the user's choice.
Dissert. Abstr.

N81-24844# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
A TWO-CELL MODEL OF SEARCH FOR AN EVADING TARGET
Theodor J. Stewart Jun. 1980 28 p refs
(CSIR-TWISK-158) Avail: NTIS HC A03/MF A01

A form of game theoretical model is proposed for the problem of search for an evading target. The region of search is divided into two cells, with the evader starting in the first cell and having the objective of moving from there, through the second to some goal area, without being detected. Optimal searcher strategy is derived in analytical form for some special cases of practical interest. The results indicate that if there is any difference in detectability in the two cells, then there is optimally a rather large concentration of search effort in the more favorable cell. The special cases are also compared numerically with some more general situations. Both the model and the solution serve to demonstrate the potential value of this form of approach to the problem, as well as the complexity of the problem for more general situations.
R.C.T.

N81-24845*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PAYLOAD OPERATIONS CONTROL CENTER (POCC)
David L. Shipman, Steven R. Noneman, and E. Steven Terry Apr. 1981 80 p refs
(NASA-TM-82422) Avail: NTIS HC A05/MF A01 CSCL 12B

The Spacelab payload operations control center (POCC) timeline analysis program which is used to provide POCC activity and resource information as a function of mission time is described. This program is fully automated and interactive, and is equipped with tutorial displays. The tutorial displays are sufficiently detailed for use by a program analyst having no computer experience. The POCC timeline analysis program is designed to operate on the VAX/VMS version V2.1 computer system.
M.G.

N81-24846# Noah (J. Watson) Associates, Inc., Falls Church, Va.
A SLOT ALLOCATION MODEL FOR HIGH-DENSITY AIRPORTS Final Report
C. F. Day and J. M. White Aug. 1980 194 p refs
(Contract DOT-FA79WA-4334)
(AD-A098097; FAA-APO-80-13) Avail: NTIS HC A09/MF A01 CSCL 01/5

The slot allocation model discussed in this report is formulated as a linear programming model and tailored to operations at Washington National Airport. The model is designed to accept as input the slate of slot requests presented to the Airline Scheduling Committee for the airport. The model allocates slots among users by maximizing industry profits (the sum of profits for all airlines operating at the airport) subject to constraints on runway capacity, equity, public service and noise pollution. Two versions of the model were formulated and tested. The first leads to an allocation of slots by airline, by hour of the day, but gives no information on markets served. Some representation of markets served is desirable, particularly to judge the impact of allocation on short versus long haul service. A second version of the model was, therefore, formulated which leads to a daily allocation by airline and by market (short, medium, and long haul), but not by hour or the day. Hourly allocations can be obtained by using the daily allocations generated by the second version of the model as a constraint in the first or hourly version. Both existing and proposed operating regulations for the airport were examined and alternative objective functions (maximizing passengers carried and maximizing passenger-miles generated) were tested.
Author (GRA)

N81-24847# Iowa Univ., Iowa City. Div. of Educational Psychology.
FIXED STATE UTILITY SCALING: COMPARISON OF DIFFERENT CRITERIA Technical Report, 1 Jan. - 31 Dec. 1980
Shin-ichi Mayekawa and Melvin R. Novick 20 Mar. 1981 32 p refs
(Contract N00014-77-C-0428)
(AD-A098227; TR-81-3) Avail: NTIS HC A03/MF A01 CSCL 12/1

Several methods of fitting utilities using fixed state gambles and least-squares criteria are compared. It was found that similar results are found when the maximization is done in the probability, log-odds, or root arc-sine matrix.
GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N81-24848 Illinois Univ. at Urbana-Champaign.
DECISION PROBLEMS IN RESTRICTED CLASSES OF GROUPS Ph.D. Thesis
Jody Meyer Lockhart 1980 139 p
Avail: Univ. Microfilms Order No. 8108587

The classes of finitely presented groups for which each group has solvable lambda-problem, where lambda is conjugacy, order and power, are considered. It is shown that Markov-type problems are unsolvable in these classes. Recursively enumerable classes of group presentations that have uniformly solvable word problem are considered. It is shown that for classes of recursively generated, recursively related presentations of this type most problems are unsolvable. For classes of finite presentations with uniformly solvable word problem, the properties having solvable order problem, having solvable power problem, and being torsion free are recursively unrecognizable. The triviality problem for classes of finite presentations of groups and semigroups with deficiency close to zero is investigated.
Dissert. Abstr.

N81-24849 Northeastern Univ., Boston, Mass.
LANGUAGES OVER THE REAL NUMBERS Ph.D. Thesis
Karen Ann Lemone 1979 180 p
Avail: Univ. Microfilms Order No. 8106998

The properties of real languages-generally non-denumerable collections of finite-length strings of real numbers are defined and developed. Three methods of finite-specification for real languages are described. The first is a set theoretic approach; i.e., real languages are defined as a set (of sequences of real numbers). A distance function (essentially the Hausdorff metric) provides the link between real languages and the traditional finite-alphabet languages of formal language theory. The second finite-specification for real languages is a generalization of the classical context-free grammars of finite-alphabet language theory. This generative model involves the notion of schematized productions. The third finite-specification called a real-acceptor is a finite-dimensional, linear, discrete time system which accepts real languages according to given acceptance criteria. Real acceptors are a generalization of the finite-state acceptors of automata theory. The capabilities and limitations of each specification scheme are discussed and numerous examples of real languages are given. The set of (real) languages that the generative model and the acceptor have in common is derived.
Dissert. Abstr.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N81-24850 Stanford Univ., Calif.
SCREW SURFACES IN THE ANALYSIS AND SYNTHESIS OF MECHANISMS Ph.D. Thesis
Ignacio Hernadez-Gutierrez 1981 119 p
Avail: Univ. Microfilms Order No. 8108945

The motion of a rigid body in three dimensional space can be associated with a ruled surface called the screw surface. The screw surfaces are analogous to rotation curves of two dimensional motions. The screw surface can be defined for a motion by finding the screw axes for each displacement which brings the body from one reference position to all the positions that it reaches during its motion. Methods for finding the screw surface for a given motion and alternative ways of describing a motion for a given screw surface are explained. A general plane symmetric motion is defined and it is shown that for a special case of this plane symmetric motion the screw surface is a plane. It is found that the coupler motion of spatial four bar linkages having a prismatic joint is such that its screw surface is a cylinder. This cylinder is defined by a curve resulting from its intersection with a plane perpendicular to its rulings.
Dissert. Abstr.

N81-24851# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
MATERIALS RESEARCH FOR ADVANCED INERTIAL INSTRUMENTATION. TASK 3: RARE EARTH MAGNETIC MATERIAL TECHNOLOGY AS RELATED TO GYRO TORQUERS AND MOTORS Technical Report, 1 Oct. 1979 - 30 Sep. 1980
D. Das, K. Kumar, and E. Wettstein Dec. 1980 69 p refs
(Contract N00014-77-C-0388)
(AD-A097818; R-1435; TR-3) Avail: NTIS HC A04/MF A01 CSCL 20/3

Hot isostatic pressing (HIP) of SmCo5 magnets can now be considered a viable alternative to sinter technology. Qualities of magnets are usually better. Even in as HIPed condition the magnetic properties compare favorably with commercial sintered magnets. Thermal optimization following the HIP procedure further improves the properties. Unique in these magnets, as opposed to sintered magnets, are the consistently high H subscript ci values obtained over the entire composition range of 35.5 to 37.0 weight percent m. It was interesting to note that the higher Sm compositions showed very little degradation of coercivity on slow cooling from aging temperature. GRA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N81-24852 New Hampshire Univ., Durham.
NORMAL MODE SPECTRA OF SOUND WAVES IN VISCOUS SOLID AND FLUID MEDIA WITH PARTICULAR APPLICATIONS TO SHALLOW WATER ACOUSTICS Ph.D. Thesis
Peter Geoffrey Harvey 1980 263 p
Avail: Univ. Microfilms Order No. 8108870

Sound propagation in shallow water is modelled using the Green's function formalism and normal mode techniques. The water layer is bounded above by a pressure-released condition and below by a halfspace viscoelastic solid media. Nine different marine sediments are investigated by incorporating their published measured parameters into the bottom boundary condition utilizing the definition of specific acoustic impedance. A depth-dependent sound speed is treated in the ideal liquid layer. Dissert. Abstr.

N81-24853*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
ON THE GENERATION OF SIDE-EDGE FLAP NOISE Final Report
M. S. Howe Washington NASA Jun. 1981 46 p refs
(Contract NAS1-16142)
(NASA-CR-3437) Avail: NTIS HC A03/MF A01 CSCL 20A

A theory is proposed for estimating the noise generated at the side edges of part span trailing edge flaps in terms of pressure fluctuations measured just in-board of the side edge of the upper surface of the flap. Asymptotic formulae are developed in the opposite extremes of Lorentz contracted acoustic wavelength large/small compared with the chord of the flap. Interpolation between these limiting results enables the field shape and its dependence on subsonic forward flight speed to be predicted over the whole frequency range. It is shown that the mean width of the side edge gap between the flap and the undeflected portion of the airfoil has a significant influence on the intensity of the radiated sound. It is estimated that the noise generated at a single side edge of a full scale part span flap can exceed that produced along the whole of the trailing edge of the flap by 3 dB or more. Author

N81-24854*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STOCHASTIC ANALYSIS OF SPECTRAL BROADENING BY A FREE TURBULENT SHEAR LAYER
Jay C. Hardin and John S. Preisser May 1981 27 p refs
(NASA-TP-1816; L-14444) Avail: NTIS HC A03/MF A01 CSCL 20A

The effect of the time-varying shear layer between a harmonic acoustic source and an observer on the frequency content of the observed sound is considered. Experimental data show that the spectral content of the acoustic signal is considerably broadened upon passing through such a shear layer. Theoretical analysis is presented which shows that such spectral broadening is entirely consistent with amplitude modulation of the acoustic signal by the time-varying shear layer. Thus, no actual frequency shift need be hypothesized to explain the spectral phenomenon. Experimental tests were conducted at 2, 4, and 6 kHz and at free jet flow velocities of 10, 20, and 30 m/s. Analysis of acoustic pressure time histories obtained from these tests confirms the above conclusion, at least for the low Mach numbers considered. A.R.H.

N81-24855*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AIRPORT NOISE IMPACT REDUCTION THROUGH OPERATIONS
Richard DeLoach May 1981 25 p refs Presented at Aircraft Safety and Operating Problems Conf., Hampton, Va., 5-7 Nov. 1980 Submitted for publication
(NASA-TM-81970) Avail: NTIS HC A02/MF A01 CSCL 20A

The airport-noise levels and annoyance model (ALAMO) developed at NASA Langley Research Center is comprised of a system of computer programs which is capable of quantifying airport community noise impact in terms of noise level, population distribution, and human subjective response to noise. The ALAMO can be used to compare the noise impact of an airport's current operating scenario with the noise impact which would result from some proposed change in airport operations. The relative effectiveness of number of noise-impact reduction alternatives is assessed for a major midwest airport. Significant reductions in noise impact are predicted for certain noise abatement strategies while others are shown to result in relatively little noise relief. A.R.H.

N81-24856*# Oklahoma State Univ., Stillwater. School of Mechanical and Aerospace Engineering.
DIAGNOSTIC EXPERIMENTS ON SUPERSONIC JET NOISE Final Report
Dennis K. McLaughlin 30 Apr. 1981 58 p refs
(Grant NAG1-10)
(NASA-CR-164348) Avail: NTIS HC A04/MF A01 CSCL 20A

Experiments and computations on the flowfield and radiated noise of supersonic model jets are discussed. The shock associated noise produced by large scale instabilities in underexpanded supersonic jets, the nonlinear propagation distortion phenomenon in the noise radiated by supersonic model jets, and computations of instability evolution and radiated noise using the LSNOIS computer code are addressed. M.G.

N81-24857*# Kansas Univ., Lawrence. Flight Research Lab.
STUDY OF NOISE REDUCTION CHARACTERISTICS OF MULTILAYERED PANELS AND DUAL PANE WINDOWS WITH HELMHOLTZ RESONATORS
Ramasamy Navaneethan May 1981 176 p refs
(Contract NCC1-6)
(NASA-CR-164370; KU-FRL-417-16) Avail: NTIS HC A09/MF A01 CSCL 20A

The experimental noise attenuation characteristics of flat, general aviation type, multilayered panels are discussed. Experimental results of stiffened panels, damping tape, honeycomb materials and sound absorption materials are presented. Single degree of freedom theoretical models were developed for sandwich type panels with both shear resistant and non-shear resistant core material. The concept of Helmholtz resonators used in conjunction with dual panel windows in increasing the noise reduction around a small range of frequency was tested. It is concluded that the stiffening of the panels either by stiffeners or by sandwich construction increases the low frequency noise reduction. E.A.K.

N81-24858# Pennsylvania State Univ., University Park. Applied Research Lab.
THE EFFECT OF INLET TURBULENCE AND STRUT GENERATED DISTURBANCES ON TURBOMACHINERY NOISE
R. Trunzo 25 Sep. 1980 160 p refs
(Contract N00024-79-C-6043)
(AD-A098140; ARL/PSU-TM-80-197) Avail: NTIS HC A08/MF A01 CSCL 20/1

This thesis presents results of an investigation in which turbomachine rotor sound spectra variations were correlated with aerodynamic measurements of the inlet turbulence, strut wake, and vortex flow strength. Aerodynamic measurements that were made included mean velocity and turbulence intensity profiles, and the axial length scales. Inlet turbulence data indicate that the major effect of the flow contraction appears to be the elongation of atmospheric turbulent eddies from 20 cm to 200 cm. Eddies of this size dominate the generation of blade passing frequency (BPF) noise. Reducing the eddy size by the use of a grid revealed the vortex flow strength to be the second major source of noise at BPF. A doubling of vortex flow strength produced a 6 dB increase in the source pressure level (SPL) of the first BPF. The variation of the SPL with the decay of the strut wake was small. The SPL showed less than a 2 dB change with a doubling of the wake turbulence intensity or the velocity defect. The measured sound spectra were compared with predicted trends from two different analyses. The results of this comparison further supported the conclusion that the strut wake structure was not as effective in producing noise at the vortex strength or the inlet turbulent eddies. A discussion of the relative importance of various sources of noise due to the flow field is given. GRA

N81-24859# Naval Postgraduate School, Monterey, Calif.
THE PROPAGATION OF A SCATTERED ACOUSTIC BOUNDARY WAVE OVER A ROUGH WEDGE M.S. Thesis
Stephen Joe Hollis Dec. 1980 143 p refs
(AD-A098048) Avail: NTIS HC A07/MF A01 CSCL 20/1

The theory for the generation of a scattered acoustic boundary wave over a slightly rough planar surface was developed by I. Tolstoy and experimentally verified by Medwin et al., propagation of the boundary wave over a wedge is studied. It is found that the boundary wave and the geometrically spreading volume wave diffract from the crest in the same manner. The amplitude ratio of the boundary wave to the diffracted volume wave, where the growth of the boundary wave from the crest is due to a phased line source at the crest caused by the diffracting volume wave, was found to have an average frequency dependence, sq f, and an average range dependence, E to the 0.5 power. The amplitude ratio of boundary wave to diffracted volume wave due to propagation over the rough wedge gave an average frequency dependence of sq f and an average range dependence of R to the 0.3 power. Low wave number grazing propagation over a wedge produces a boundary wave whose amplitude can be many times that of a diffracted volume wave for a smooth surfaced wedge. GRA

N81-24860# Naval Postgraduate School, Monterey, Calif. Dept. of Physics and Chemistry.
BACKSCATTER FROM A COMPOSITE ROUGH SURFACE M.S. Thesis
Wilson Banks Decker Dec. 1980 83 p refs
(AD-A098049) Avail: NTIS HC A05/MF A01 CSCL 20/1

Backscatter of acoustic signals generated by surfaces having point scattering and line scattering features is studied experimentally in air. Signals are analyzed for propagation over three models: a smooth plane wedge, a wedge whose surface is slightly roughened with uniformly-packed lead shot, and one randomly roughened with gravel. Scattering from the rough surfaces at normal incidence is measured to estimate the statistical parameters that describe the surface roughness. The returned acoustic energy from the composite area of rough surface and wedge for low grazing angles is analyzed to determine whether the identity of the two individual backscatter effects can be separated in their combined spectrum. The near grazing backscattered amplitudes are much larger than predicted by conventional rough surface scattering theory and suggest the presence of a backscattered boundary wave. Author (GRA)

N81-24861# Naval Postgraduate School, Monterey, Calif.
FINITE-AMPLITUDE STANDING WAVES IN A RECTANGULAR CAVITY WITH WEDGE-TYPE BOUNDARY PERTURBATION M.S. Thesis
Ilbok Joung Dec. 1980 55 p refs
(AD-A098064) Avail: NTIS HC A04/MF A01 CSCL 20/1

Finite amplitude acoustic standing waves in a rectangular airfilled cavity with various wedge shape boundary perturbations were studied both experimentally and theoretically. The experimental results showed that geometrical perturbations alter the finite amplitude behavior of the cavity and that the nature of these changes are in qualitative agreement with the predictions of the theory. However, quantitative agreement was not observed possibly because the perturbation chosen did not satisfy all the assumptions of theory. There does not seem to be any fundamental obstacle preventing the choice of a perturbation that would allow the theory to be critically tested. GRA

N81-24862# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
TEMPORAL INTEGRATION IN LOW FREQUENCY AUDITORY DETECTION Final Report
Richard Horonjeff, Sanford Fidell, Sherri Teffeteller, and David M. Green Fort Eustis, Va. Army Research and Technology Lab. Mar. 1981 67 p refs
(Contract DAAK51-80-C-0008; DA Proj. 1L1-62209-AH-76)
(AD-A098161; BBN-4435; USAAVRADCOM-TR-81-D-8) Avail: NTIS HC A04/MF A01 CSCL 17/1

This report describes research undertaken to determine whether the Applied Technology Laboratory's existing procedures for predicting detection ranges of helicopters require revision to account for any potential differences in the time period over which people integrate signal energy at different frequencies. Findings disclosed that over the frequency range of 40 to 1000 Hz the integration time of the human auditory system was essentially invariant at approximately 240 milliseconds. Although no change to the ATL detection range program was required, incorporation of temporal effects was recommended to improve the generality of the program. GRA

N81-24863# Adaptronics, Inc., McLean, Va.
DEVELOPMENT OF AN ADVANCED, AUTOMATIC, ULTRASONIC NDE IMAGING SYSTEM VIA ADAPTIVE LEARNING NETWORK SIGNAL PROCESSING TECHNIQUES Final Technical Report, 15 Mar. 1978 - 15 Mar. 1981
Leo J. OBrien, Nancy A. Aravanis, James R. Gouge, Jr., and Anthony N. Mucciardi 13 Mar. 1981 152 p refs Submitted for publication
(Contract MDA903-78-C-0223; DARPA Order 3553)
(AD-A097740; ADI-REF-531) Avail: NTIS HC A08/MF A01 CSCL 20/1

A conventional pulse-echo imaging system has been modified to operate with a linear ultrasonic array and associated digital electronics to collect data from a series of defects fabricated in aircraft quality steel blocks. A thorough analysis of the defect responses recorded with this modified system has shown that

considerable improvements over conventional imaging approaches can be obtained in the crucial areas of defect detection and characterization. A combination of advanced signal processing concepts with the Adaptive Learning Network (ALN) methodology forms the basis for these improvements. Use of established signal processing algorithms such as temporal and spatial beam-forming in concert with a sophisticated detector has provided a reliable defect detection scheme which can be implemented in a microprocessor-based system to operate in an automatic mode. It is shown that signal features extracted from the detected responses contain diagnostic information which enables the defect to be characterized as to type, orientation, and size. Direct comparisons are made between conventional defect images and results obtained from this study; these demonstrate the improvements obtained with the new approach. Author (GRA)

N81-24864# Weapons Systems Research Lab., Adelaide (Australia).
AN EXTENSION OF A PREVIOUS RESULT ON THE ANALYSIS OF A METHOD OF MEASURING THE SIGNAL-TO-NOISE RATIO OF A SINUSOID IN NOISE
A. P. Clarke Sep. 1980 27 p refs
(AD-A098306; WSRL-0169-TM) Avail: NTIS HC A03/MF A01 CSCL 20/1

This paper presents the derivation of closed form expressions for the probability density function and the associated mean and variance when estimating tonal signal-to-noise ratio from a power spectrum obtained as the average of a set of power spectra. Computer programs are described that can aid in experimental design and some possible lines of examination are indicated. Author (GRA)

N81-24865# Technische Physische Dienst TNO-TH, Delft (Netherlands). Noise Dept.
A STEAM INJECTION UNDERWATER SOUND SOURCE FOR SIMULATING CAVITATION NOISE
K. Verhulst 31 Oct. 1978 11 p refs In DUTCH; ENGLISH summary
(TPD-808.720) Avail: NTIS HC A02/MF A01

The investigation of propeller noise under laboratory circumstances requires an underwater noise source which has a well-defined source strength and resembles cavitation noise. Such an underwater sound source was developed by means of the injection of steam into water. The acoustic source strength of such a device was determined using two methods. The first method is based on the reverberation theory in a reverberating watertank. The second method applies the so-called reciprocal method. The results of both methods agree well. Author (ESA)

N81-24866# Technische Physische Dienst TNO-TH, Delft (Netherlands).
SMALL EXPLOSIVE SOURCES FOR USE IN UNDERWATER SOUND EXPERIMENTS ON SHIPS
J. W. Verheij 25 Jan. 1979 37 p refs
(TNO-808.780/2) Avail: NTIS HC A03/MF A01

The use of 40 gram charges as underwater sound sources in reciprocal measurements of sound transmission in ships was investigated. A series of ten TNT charges was detonated in shallow water (approximate depth: 5 m). Sound propagation to hydrophones at a distance of 48 m and 165 m was compared with that for a CW source. Results show that nonlinearities or bubble migration have no influence on the sound attenuation between these hydrophones. A large number of sound transmission measurements were performed on board a frigate, using as a source underwater explosions of 40 g plastic charges at a distance of approximately 25 m. Again comparison with a CW source does not reveal any nonlinear influences. To obtain the full advantage of the large source strengths, it is recommended that the dynamic range of the response signals be reduced before recording, for instance by application of low pass filters. Otherwise many low frequency measurements are lost due to the dynamic range limitations of the tape recorders. Author (ESA)

N81-24867# Technische Physische Dienst TNO-TH, Delft (Netherlands).
SOUND TRANSFER VIA RESILIENT MOUNTS FROM SEPARATE EXCITATION WITH ORTHOGONAL TRANSLATIONS AND ROTATIONS: DEVELOPMENT AND TEST OF A MEASUREMENT TECHNIQUE
J. W. Verheij 11 Jan. 1980 60 p refs Original contains color illustrations
(Contracts A75/KM/004; A72/KM/003)
(TNO-908.835) Avail: NTIS HC A04/MF A01

The measurement of the sound transmission properties of resilient mounts for machinery in ships is considered. A measurement method is presented which determines five transfer functions related to the compressive, transverse, torsional and bending stiffness of a mount. The method of measurement is part of a procedure which enables an accurate analysis of those factors which limit the effectiveness of a resilient mounting system with respect to the reduction of noise radiation into the water. Special attention is given to the separation of excitation by transverse accelerations and that by a rotation on a horizontal axis. Author (ESA)

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N81-24868 Washington Univ., Seattle.
DEVIATIONS FROM RUTHERFORD SCATTERING IN INSUBCOULOMB HEAVY-ION ELASTIC SCATTERING Ph.D. Thesis
William G. Lynch 1980 210 p
Avail: Univ. Microfilms Order No. 8109749

Both theoretical and experimental investigations were carried out to look for small effects which can cause the differential cross section of sub-Coulomb heavy ion elastic scattering to differ from eht Rutherford cross section. The work focused on the elastic scattering of p shell projectiles, specifically C-12, N-14, N-15, and O-16, from the doubly majic target nucleus Pb-208 at laboratory bombarding energies ranging from 10 MeV to the Coulomb barrier. For these systems, parameter free theoretical calculations predicted that the sub-Coulomb data would be sensitive to four major effects; atomic screening, electron-positron vacuum polarization, nuclear polarization, and relativistic effect arising from the use of a relativistic wave equation in place of the Schrodinger education. Dissert. Abstr.

N81-24869 Stanford Univ., Calif.
PULSED MOLECULAR BEAM COHERENT ANTI-STOKES RAMAN SPECTROSCOPY Ph.D. Thesis
Michael Dane Duncan 1981 106 p
Avail. Univ. Microfilms Order No. 8108916

Experimental spectra of C2H2 were obtained at various distances from the pulsed molecular beam source. Linewidths narrower than static gas spectra were obtained, but three main resolution limiting factors were encountered; frequency jitter in the single mode Nd; YAG laser system due to thermal effects, Fourier transform limited linewidths in the dye amplifier chain due to short pulses, and saturation and Stark broadeningg in the C2H2 due to high intensity optical fields. The temperatue of C2H2 vs distance from the pulsed source was measured and was found to agree qualitatively with simple gas dynamic theories. Discrepancies were attributed to the formation of clusters within the molecular beam. A simple theory was used to predict saturation and stark broadening, and the results agreed well with theory. Dissert. Abstr.

N81-24870 Minnesota Univ., Minneapolis.
THE DYNAMICAL STRUCTURE OF THE PION Ph.D. Thesis
Emmanuel Abdiyah Abdul Haqq 1980 93 p
Avail: Univ. Microfilms Order No. 8109443

The dynamics of light quarks was studied using a modified New Tamm-Dancoff amplitude. This amplitude naturally leads to linear confining potential. The short distance structure of the equation is similar to the Salpeter equation. An examination of the potential showed that, at distances small compared to the Compton wavelength of the quarks, the Coulombic potential is suppressed and the $1/r$ singularity is reduced to a logarithmic

one. The suppression of the singularity resulted in a finite value for the component of the wavefunction which is related to pion decay. It was, therefore, possible to give an unambiguous calculation of f sub pi, the pion decay constant. Numerical calculations of the masses of the pion and the B meson were made as well as calculations of f sub pi and the charge radius of the pion. The numerical results to the necessity of including magnetic interactions which were neglected in this calculation. Dissert. Abstr.

N81-24871 Carnegie-Mellon Univ., Pittsburgh, Pa.
THE PHENOMENOLOGY OF HIGGS PARTICLES IN GAUGE THEORIES OF THE ELECTROWEAK INTERACTION Ph.D. Thesis
Bruce Marshall McWilliams 1980 122 p
Avail: Univ. Microfilms Order No. 8107882

The possibility of observing Higgs particles through virtual effects is considered in detail for a general gauge theory. The effect of charged Higgs particles on the low energy weak interaction processes of muon decay, tau decay, nuclear beta decay, pion decay, and some higher order processes are given. Rough lower bounds are put on the masses of Higgs particles in a few models of interest from experimental measurements of these processes. Production mechanisms at high energies for Higgs particles and their signatures are discussed. Dissert. Abstr.

N81-24872 Illinois Univ. at Urbana-Champaign.
THE SEMI-CLASSICAL APPPROXIMATION IN A HIERARCHY OF MODELS WITH INSTATONS Ph.D. Thesis
Robert Allen Neinast 1980 88 p
Avail: Univ. Microfilms Order No. 8108612

The path integral approach to the semiclassical approximation is used to analyze three models admitting instatons, with the eventual hope of being able to apply the things learned there to analyzing quantum chromodynamics. The simplest model is a simple one dimensional double-well potential, where a complete instaton-anti-instaton calculation is done and the level splitting between the ground and first excited states of the potential is found. In a two dimensional nonlinear sigma model it is shown that the Coulomb gas picture of quantum fluctuations around only instatons is exactly equivalent to a dilute gas of instatons. Four dimensional sigma lambda hyperon sigma models, which are both nonlinear sigma models and non-Abelian gauge theories are introduced and discussed. By providing a bridge between the two kinds of theories, these models could be especially helpful in applying the knowledge gained from the simpler model to the more complicated one. Dissert. Abstr.

N81-24873 Illinois Univ. at Urbana-Champaign.
SEMICLASSICAL METHODS IN FIELD THEORIES: THE USE OF SOLUTION AND INSTATON Ph.D. Thesis
Yupai Hsu 1980 148 p
Avail: Univ. Microfilms Order No. 8108546

The interaction of solitons among themselves in Sine-Gordon system was studied. The information encoded in various known soliton solutions such as scattering time delays and oscillation periods were translated into that of the corresponding quantities in particle dynamics. Different points of view for obtaining the interaction potentials were examined. The effective potentials were quantitized and the mass spectrum was compared with that obtained from the path integral approximation. The instaton physics in Sigma model and in nonabelian gauge theory was studied. An instaton solution defines a dominant collective coordinate. By considering only the quantum physics along these coordinates (a good approximation in weak coupling limit), a complicated field theory problem was reduced to a simple Schroedinger type problem. Dissert. Abstr.

N81-24874 Stanford Univ., Calif.
A STUDY OF LEADING STRANGE MESON RESONANCES AND SPIN-ORBIT SPLITTINGS IN K-p YIELDS K-pi (+)n AT 11 GeV/C Ph.D. Thesis
Alan Kern Honma 1981 254 p
Avail: Univ. Microfilms Order No. 8108947

The angular distribution for this meson-meson scattering is studied by using both a spherical harmonic moments analysis and a partial wave analysis (PWA). Structure in the P wave amplitude indicates resonance behavior in the mass region near 1700 MeV. In two of the four ambiguous solutions for the mass region above 1800 MeV, there is strong evidence for another P wave resonant structure near 2100 MeV. The observed strange meson resonances are found to have a natural interpretation in terms of states predicted by the quark model. In particular, the mass splittings of the leading trajectory natural spin-parity strange meson states and the mass splittings between the spin-orbit triplet states are discussed. Dissert. Abstr.

N81-24875 Oregon State Univ., Corvallis.
RESPONSE OF TWO-LEVEL ATOMS TO INTENSE AMPLITUDE MODULATED LASER BEAMS Ph.D. Thesis
Barbara Blind 1981 124 p
Avail: Univ. Microfilms Order No. 8109992

The optical Bloch equation for a two-level atom in a laser beam with an amplitude of arbirary time dependence are derived in the rotating wave approximation. The light scattered by the atom is investigated for the special case of an intense, resonant laser beam with a sinusoidally modulated amplitude. The coherent part and the incoherent part of the scattered intensity are calculated. The results for this modulated amplitude dynamic Stark effect and for the constant amplitude dynamic Stark effect are compared. The modulation introduces new peaks in the frequency distribution. The total intensities when plotted as functions of the average Rabi frequency exhibit parametric resonances. The results in the limit of zero modulation depth are in agreement with the results of the constant amplitude dynamic Stark effect. Dissert. Abstr.

N81-24876 Stanford Univ., Calif.
PARITY VIOLATING ASYMMETRIES AND WEAK NEUTRAL CURRENTS Ph.D. Thesis
Thomas Tsao 1981 123 p
Avail: Univ. Microfilms Order No. 8109007

The vector and axial couplings of leptons and quarks to the weak neutral current are studied by focusing on the parity violating asymmetries which arise in the following scattering processes: polarized-electron nucleon elastic collisions, dilepton production in polarized-proton proton scattering, polarized-electron positron annihilation into fermion pairs, and polarized-electron electron collisions. Numerical results are presented for the Weinberg-Salam model of electroweak interactions. It is found that at q(2) - 1 GeV(2) the parity violating asymmetries for elastic electron nucleon collisions are typically O(0.00001) for proton, neutron, and deuteron targets. For dilepton production at presently available energies of s- 0.01 GeV(2) the parity violating asymmetries are O(0.01) while at much higher energies s - 640,000 GeV(2), the asymmetries are O(0.01). Electron positron annihilation give parity violating asymmetries that are typically O(0.1 to 1) for s near the Z deg pole. Polarized-electron electron scattering yields parity violating asymmetries of O(0.01) at s approx = 10,000 GeV(2). The restrictions imposed on the parameters of the six-quark model by the neutral kaon system are discussed--with quantum chromodynamic effects included in the leading logarithmic approximation. Dissert. Abstr.

N81-24877*# Colorado State Univ., Fort Collins. Dept. of Physics.
RECTANGULAR BEAM (5 X 40 cm MULTIPOLE ION SOURCE) M.S. Thesis - Nov. 1979
Curtis M. Haynes Dec. 1980 106 p refs
(Grant NsG-3086)
(NASA-CR-165239) Avail: NTIS HC A06/MF A01 CSCL 20H

A 5 x 40 cm rectangular-beam ion source was designed and fabricated. A multipole field configuration was used to facilitate design of the modular rectangular chamber, while a three-grid ion optics system was used for increased ion current densities. For the multipole chamber, a magnetic integral of 0.000056 Tesla-m was used to contain the primary electrons. This integral value was reduced from the initial design value, with the reduction found necessary for discharge stability. The final value of magnetic integral resulted in discharge losses at typical operating conditions which ranged from 600 to 1000 eV/ion, in good agreement with the design value of 800 eV/ion. The beam current density at the ion optics was limited to about 3.2 mA/sq cm at 500 eV and to about 3.5 mA/sq cm at 1000 ev. The effects of nonuniform ion current,

dimension tolerance, and grid thermal warping were considered. The use of multiple rectangular-beam ion sources to process wider areas than would be possible with a single source (approx. 40 cm) was also studied. Beam profiles were surveyed at a variety of operating conditions and the results of various amounts of beam overlap calculated. M.G.

N81-24878*# Colorado State Univ., Fort Collins. Dept. of Physics.
ION SOURCE DESIGN FOR INDUSTRIAL APPLICATIONS Final Report
Harold R. Kaufman and Raymond S. Robinson Jan. 1981 80 p refs
(Grant NsG-3086)
(NASA-CR-165334) Avail: NTIS HC A05/MF A01 CSCL 20H

The design of broad-beam industrial ion sources is described. The approach used emphasizes refractory metal cathodes and permanent-magnet multipole discharge chambers. Design procedures and sample calculations are given for the discharge chamber, ion optics, cathodes, and magnetic circuit. Hardware designs are included for the isolator, cathode supports, anode supports, pole-piece assembly, and ion-optics supports. There are other ways of designing most ion source components, but the designs presented are representative of current technology and adaptable to a wide range of configurations. Author

N81-24879# Washington Univ., Seattle. Dept. of Chemistry.
ENERGY TRANSFER AT HIGH TEMPERATURES IN THE CYCLOPROPANE VEM SYSTEM. TEMPERATURE DEPENDENCE OF > DELTA E PRIME <
T. Kasai, D. F. Kelley, and B. S. Rabinovitch 15 Mar. 1981 11 p refs
(Contract N00014-75-0690; NR Proj. 092-549)
(AD-A097726; TR-19) Avail: NTIS HC A02/MF A01 CSCL 07/3

The study of collisional energy transfer between cyclopropane molecules and a seasoned silica wall by the Variable Encounter Method has been extended upward in temperature to 1325 K. The value of (delta epsilon) the average energy of a down transition upon collision of the substrate with the wall continues to decrease monotonically. The data provide the most accurate and well documented display of the temperature trend of (delta epsilon) presently available. Author (GRA)

N81-24880# Washington Univ., Seattle. Dept. of Chemistry.
SINGLE COLLISION GAS-SURFACE VIBRATIONAL ENERGY TRANSFER IN A REACTING SYSTEM
D. F. Kelley, T. Kasai, and B. S. Rabinovitch 15 Mar. 1981 15 p refs Submitted for publication
(Contract N00014-75-C-0690; NR Proj. 092-549)
(AD-A097725; TR-20) Avail: NTIS HC A02/MF A01 CSCL 07/3

Gas-surface vibrational energy accommodation in a reactive system has been studied under single collision conditions. The reaction system is the isomerization of cyclobutene to 1,3-butadiene. Both seasoned pyrex and silica surfaces were used over the temperature ranges 400-775 K and 500-975 K, respectively. Strong collider behavior was observed below about 425 K. The vibrational energy accommodation coefficient was found to decrease with rise of temperature from about 1.0 to 0.2, while the relative collisional efficiency Beta sub 1 declined from about 1.0 to 0.008. A stochastic model was used to fit the data. GRA

N81-24881# Science Applications, Inc., Palo Alto, Calif.
PROPAGATION OF LOW-GAMMA ION BEAMS: THE RESISTIVE HOSE INSTABILITY
R. Leon Feinstein 30 Dec. 1980 62 p refs
(Contract N00014-79-C-0221)
(AD-A097941; SAI-1-227-00-413-00) Avail: NTIS HC A04/MF A01 CSCL 20/8

In this report on the propagation of low gamma ion beams, we explore the resistive hose instability with longitudinal velocity spread. For energies of interest, the theoretical models of electron beam propagation, cannot be directly applied to ions because of their low relativistic gamma factors. If the beam propagates in the longitudinal direction (along the z-axis), the effective inertial mass of the beam particles in the z direction is given approximately by gamma cubed m, where m is the particle test mass. This suggests that light ions are considerably more susceptible to longitudinal acceleration than electrons of equivalent kinetic energy; the longitudinal particle motion cannot be ignored as in the electron case. This adds a new dimension to ion beam propagation. The consequences of the longitudinal motion on beam stability can divided into three categories: (1) longitudinal spreading of the beam pulse due to longitudinal velocity spread (longitudinal temperature); (2) longitudinal mass (bunching) instability; and (3) resistive hose instability with longitudinal velocity spread. GRA

N81-24882# Naval Research Lab., Washington, D. C.
GENERATION AND IMPROVEMENT OF THE GYROTRON ELECTRON BEAM IN A BIASED CUSP MAGNETIC FIELD
Carolyn Kyler and K. R. Chu 23 Apr. 1981 23 p refs
(Contract DE-AI01-80-ER-52065)
(AD-A097997; NRL-MR-4401) Avail: NTIS HC A02/MF A01 CSCL 20/8

Transition of an electron beam through a biased magnetic cusp field can result in higher perpendicular to parallel velocity ratio or lower momentum spread. Analytical relations for the transformation of velocity ratio and momentum spread across the magnetic cusp are derived on the assumption of adiabatic electron motion. A single particle trajectory code is developed investigate the nonadiabatic electron behavior in two models of a biased cusp magnetic field. After intensive data analysis, some general conclusions are presented on the prospects of generation and improvement of the gyrotron electron beam in a biased cusp magnetic field. GRA

N81-24883# Harry Diamond Labs., Adelphi, Md.
CUTOFF THEORY OF IMPACT BROADENING AND SHIFTING OF MICROWAVE AND INFRARED MOLECULAR SPECTRA
Richard P. Leavitt and David Korff Jan. 1981 55 p refs
(DA Proj. 1L1-61101-A-91A)
(AD-A098315; HDL-TR-1941) Avail: NTIS HC A04/MF A01 CSCL 07/4

An impact theory is described for pressure broadening and shifting of rotation-vibration lines using a natural cutoff. The theory is based on Anderson's theoretical framework and employs an exponential expansion of the collision matrix elements derived from a linked cluster theorem for degenerate states. The final expression for the interruption function is similar in form to Gordon's semiclassical interruption function. Closed-form expressions for the broadening and shift cross sections are given for exactly resonant dipole-dipole collisions, and an exact calculation for the HC1 self-broadening in the 0 to 2 vibrational band. Author (GRA)

N81-24884# SRI International Corp., Menlo Park, Calif. Molecular Physics Lab.
PROPERTIES OF THE EXCITED STATES OF MOLECULAR IONS Final Report, 1 Oct. 1977 - 15 Sep. 1980
Philip C. Cosby, John T. Moseley, James R. Peterson, G. P. Smith, R. V. Hodges, L. C. Lee, and H. P. Helm 13 Apr. 1981 127 p refs Sponsored in part by AFOSR AND AFGL
(Contract DAAG29-77-C-0037)
(AD-A098265; SRI-MP-81-72; ARO-15069.8-P) Avail: NTIS HC A07/MF A01 CSCL 20/9

The techniques of photodissociation-spectroscopy and photofragment spectroscopy were developed and applied to characterize the excited states of a number of important molecular ions that occur in both natural and laboratory discharges and plasmas. Dissociative excited states in O2(+) and NO(+) were identified, together with their predissociation mechanisms, using photofragment spectroscopy techniques. This work yielded an order of magnitude improvement in resolution over conventional spectroscopic techniques, measurements of predissociation lifetimes, and several new observations of molecular dynamics and properties. These studies will have a major impact on current knowledge of NO(+) excited states. The structure of the OONO(-) isomer of NO3(-) was confirmed, and the probable mechanism for its stabilization in atmospheric reactions was identified as due to clustering with H2O, which preserves its structure and prevents conversion to NO3(-). The possibility that previous

observations of CO3(-) photodissociation in a drift tube can be attributed to excited ions was investigated. The results showed that the drift tube CO3(-) ions are in the ground state, but were not able to resolve the discrepancy in the CO3(-) bond dissociation energy. GRA

N81-24885# California Univ., Berkeley. Lawrence Berkeley Lab. Accelerator and Fusion Research Div.
DEVELOPMENTS IN ACCELERATORS AND INSTRUMENTATION RELEVANT TO IMAGING WITH CHARGED PARTICLES AND POSITRON EMITTERS
Jose R. Alonso Nov. 1980 33 p refs Presented at the Conf. on Biol. Imaging: Contrib. Contemporary Phys. and Eng., La Jolla, Calif., 16-18 Nov. 1980
(Contract W-7405-eng-48)
(LBL-12074; CONF-801180-1) Avail: NTIS HC A03/MF A01

The relationship between accelerators and medicine is investigated in some detail, with an emphasis on the technology associated with these accelerators and the criteria which make for successful incorporation of these machines into the clinical environment. The different kinds of accelerators found in medical use are reviewed briefly discussing the salient points of each. DOE

N81-24886# California Univ., Berkeley. Lawrence Berkeley Lab. Nuclear Science Div.
FUTURE RELATIVISTIC HEAVY ION EXPERIMENTS
Howel G. Pugh Dec. 1980 23 p refs Presented at the Workshop on Future Relativistic Heavy Ion Experiments, Darmstadt, West Germany, 7-10 Oct. 1980
(Contract W-7405-eng-48)
(LBL-11974; CONF-8010154-2) Avail: NTIS HC A02/MF A01

Equations of state for nuclear matter and ongoing experimental studies are discussed. Relativistic heavy ion physics is the only opportunity to study in the laboratory the properties of extended multiquark systems under conditions such that quarks might run together into new arrangements previously unobserved. Several lines of further study are mentioned. DOE

N81-24887# California Univ., Berkeley. Lawrence Berkeley Lab.
LASER INDUCED FLUORESCENCE OF TRAPPED MOLECULAR IONS
J. S. Winn Oct. 1980 29 p refs Presented at NATO Intern. Advanced Study Inst. on Molecular Ions: Geometric and Electron. Structures, Kos, Greece, 30 Sep. 1980
(Contract W-7405-eng-48)
(LBL-12002; CONF-8009131-1) Avail: NTIS HC A03/MF A01

A method by which the simplifying aspects of laser induced fluorescence can be extended to molecular ion spectroscopy is described. DOE

N81-24888# Oak Ridge National Lab., Tenn. Engineering Physics Div.
PHENOMENOLOGICAL MODEL FOR PARTICLE PRODUCTION FROM THE COLLISIONS OF NUCLEONS AND PIONS WITH FISSILE ELEMENTS AT MEDIUM ENERGIES
F. S. Alsmiller, R. G. Alsmiller, Jr., T. A. Gabriel, R. A. Lillie, and J. Barish Mar. 1981 73 p refs Submitted for publication
(Contract W-7405-eng-26)
(ORNL/TM-7528) Avail: NTIS HC A04/MF A01

A fission channel is added to the intranuclear cascade evaporation model of nuclear reactions so that this model may be used to obtain the differential particle production data that are needed to study the transport of medium energy nucleons and pions through fissionable material. Earlier work on the incorporation of fission evaporation competition into the intranuclear cascade evaporation model is retained, and the statistical model of fission is utilized to predict particle production from the fission process. Approximate empirically derived kinetic energies and deformation energies are used in the statistical model. The calculated number of emitted neutron and residual nuclei distributions are in reasonable agreement with experimental data, but the number of emitted neutrons at the higher incident nucleon energies (approximately > 500 MeV) are sensitive to the level density parameter used. DOE

N81-24889# Los Alamos Scientific Lab., N. Mex. Theoretical Div.
REMARKS ON THE S-SHELL LAMBDA-HYPERNUCLEI
B. F. Gibson and D. R. Lehman (George Washington Univ.) 1981 17 p refs Presented at the Nucl. and Particle Phys. Workshop, Los Alamos, N. Mex., 5-8 Jan. 1981
(Contract W-7405-eng-36)
(LA-UR-81-189; CONF-810115-4) Avail: NTIS HC A02/MF A01

The complexities of the s-shell lambda hypernuclei (A = < or = 5) are explored. Difficulties associated with attempts to describe the hypercon nucleon (YN) interaction in all such lambda hypernuclei by simple, effective lambda p and lambda n potentials are examined. The explicit A dependence of the effective YN interaction due to lambda N-sigma N coupling and isospin differences among the nuclear core states is investigated. The necessity of using exact four body theory to calculate small charge symmetry breaking effects (in the A = 4 system) using lambda N potentials fitted to free lambda N scattering data is emphasized. Possible use of s-shell hypernuclear binding energies to help distinguish among candidate YN potential parameterization is discussed. DOE

N81-24890# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.
RECENT ACTIVITIES AT CENTRO INFORMAZIONI STUDI ESPERIENZE TANDEM
E. Caruso and F. Cristofori 1980 15 p refs Presented at the 5th Tandem Conf., Catania, Italy, 9-12 Jun. 1980
(CISE-1594) Avail: NTIS HC A02/MF A01

Installation improvements in a radiation damage, PIXE, and backscattering analysis laboratory are described; in particular the 3.5 MV CISE Tandem computer control center which is based on a S130 Eclipse central controller and Z80A microprocessor local controllers is considered. The characteristics and control requirements of existing equipment are detailed. Author (ESA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N81-24891 Lehigh Univ., Bethlehem, Pa.
MICROSCOPIC ANALYSIS OF THE BOSON DESCRIPTION OF MEDIUM WEIGHT NUCLEI Ph.D. Thesis
Faneva Randrianandraina 1981 198 p
Avail: Univ. Microfilms Order No. 8108195

The method of Ewart and de Takacsy was extended to derive microscopically the coefficients of the boson Hamiltonian from the fermion shell model Hamiltonian plus residual interaction. The pairing plus quadrupole interaction is used as the residual interaction. The fermion Hamiltonian is first written in terms of quasiparticle operators where the properties of the quasiparticle are determined by a BCS calculation. The number equation of the BCS-theory is satisfied for each energy state individually in a self-consistent manner. The coefficients in the boson Hamiltonian are determined by requiring that the matrix element of the boson operator taken between normalized phonon states be equal to the corresponding matrix element of the quasiparticle operator taken between analogous normalized fermion states. Dissert. Abstr.

N81-24892 Minnesota Univ., Minneapolis.
SOME PROBLEMS IN NUCLEAR REACTION THEORY Ph.D. Thesis
Bassam Ahmad Mughrabi 1980 137 p
Avail: Univ. Microfilms Order No. 8109476

It was found that the transfer of particles in a nuclear reaction does not always procede directly but may involve either the inelastic excitation of the target nucleus or the inelastic excitation

of the residual nucleus or both. Such multistep processes can be handled by the coupled channels Born approximation formalism. Codes exist for such calculations and involve solving homogeneous and inhomogeneous differential equations and matching to the appropriate boundary conditions. Dissert. Abstr.

N81-24893# Nebraska Univ., Lincoln. Dept. of Chemistry.
HIGH ENERGY HALOGEN ATOM REACTIONS ACTIVATED BY NUCLEAR TRANSFORMATIONS Progress Report, 15 Feb. 1980 - 14 Feb. 1981
Feb. 1981 52 p refs
(Contracts DE-AS01-76ER-01617; EY-76-S-02-1617)
(COO-1617-64) Avail: NTIS HC A04/MF A01

The stereochemistry of high energy F-18, Cl-34 m and Br-76 substitution reactions involving enantiomeric molecules in the gas and condensed phase was studied. The gas to condensed state transition in halogen high energy chemistry, involving chlorine, bromine, and iodine activated by the (n,γ) and (I.T.) processes in halomethanes, saturated and unsaturated hydrocarbons was investigated in more detail. Special attention was given to defining the nature of the enhancement yields in the condensed phase. High energy halogen reactions in liquid and frozen aqueous solutions of organic and biomolecular solutes were studied in an attempt to learn more about these reactions. DOE

N81-24894# California Univ., Livermore. Lawrence Livermore Lab.
FORMATION AND ACCELERATION OF HIGH-ENERGY NEUTRAL BEAMS FOR MAGNETIC FUSION
H. S. Staten (DOE), J. H. Fink, and P. Kortman (Scientific Applications, Inc.) 1 Feb. 1981 164 p refs Workshop held at Rockville, Md., 11-12 Dec. 1980
(Contract W-7405-eng-48)
(DOE/TIC-11371; CONF-801240) Avail: NTIS HC A08/MF A01

Sixteen topics concerning the development of high energy neutral beams were discussed. The main topics considered were beam requirements, negative ion source development programs, and accelerator concepts. DOE

N81-24895# Rockwell International Corp., Golden, Colo.
TRANSURANIC WASTE MANAGEMENT PROGRAM WASTE FORM DEVELOPMENT
W. S. Bennett and L. R. Crisler 1980 13 p refs
(Contract DE-AC04-76DP-03533)
(RFP-3138) Avail: NTIS HC A02/MF A01

Waste forms for transuranic wastes are evaluated. The assessment of the available data indicates that dewatered concretes, synthetic basalts, and borosilicate glass waste forms are viable candidates for immobilization of large fractions of the transonic inventory in a geologic repository. DOE

N81-24896# Los Alamos Scientific Lab., N. Mex.
BEAM POSITION MONITOR SYSTEM FOR THE PROTON STORAGE RING AT LAMPF
E. F. Higgings and F. D. Wells 1981 4 p refs Presented at the Particle Accelerator Conf., Washington, D.C., 11-13 Mar. 1981
(Contract W-7405-eng-36)
(LA-UR-81-599; CONF-810314-12) Avail: NTIS HC A02/MF A01

The construction of a high current proton storage ring is considered with respect to its potential to accumulate intense pulses of 800-MeV protons for delivery to neutron production targets. The beam's transverse location in the injection channel, ring, and extraction channel is determined by a beam position monitor system. The beam is detected by stripline sensors that generate 4 quadrant position signals from the spectral components of the beam. Sixty sensors are planned for the installation, with their outputs selected by broadband RF multiplexers. The sensor outputs are processed by a differential phase correlator detector to produce an analog signal proportional to the position of the beam centroid. DOE

N81-24897# Institute for Advanced Study, Princeton, N.J.
BASIC RESEARCH IN THEORETICAL HIGH ENERGY PHYSICS Progress Report
S. L. Adler 1980 14 p refs
(Contract DE-ACS2-76ER-02220)
(DOE/ER-02220/T2) Avail: NTIS HC A02/MF A01

Research in theoretical quantum chromodynamics gauge theories, relativity, and particle theory is summarized. DOE

N81-24898# Technische Universitaet, Munich (West Germany).
TRANSPORTATION OF RADIOACTIVE WASTE MATERIALS INTO SPACE. THE FINAL SOLUTION FOR INEXPENSIVE AND SAFE DISPOSAL [ATOMMUELL-LAGERUNG IM WELTRAUM. DIE ENDGUELTIGE LOESUNG FUER BILLIGE UND SICHERE ENTSORGUNG]
D. Hayn, H. O. Ruppe, and R. H. Schmucker May 1980 35 p refs In GERMAN Presented at 29th HOG Tagung in Feucht bei Nuernberg. 26-29 Jun., 1980
(TUM-RT-KB-80/2) Avail: NTIS HC A03/MF A01

Technical problems and costs are outlined for the disposal of radioactive waste. Options discussed include : (1) Storage on the surface of a celestial body (Earth, planets, Sun, Moon), (2) undirected disposal (in the sea, random escape from the solar system), and (3) Storage in space (in Earth orbit, other orbits, or outside the solar system, directly, or using the swingby technique). Costs versus velocity requirements for various orbits are shown for expendable and reusable shuttles, both liquid and solid fuelled. The safety aspects are mentioned. Author (ESA)

N81-24899# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.
SHUFFLING, DIC, PROBA IN CELLS: THREE PECULIAR DEVICES FOR FUEL IRRADIATION TESTS
A. DeCesare, R. Gozzo, F. Mantega, A. Oriani, G. Piazzini, A. Squilloni, and G. Vanoli 1980 19 p refs Presented at the 26th Meeting of Irradiation Devices Working Group, Geesthacht, West Germany, 8-10 Oct. 1980 Sponsored by CNEN
(CISE-1625) Avail: NTIS HC A02/MF A01

Three support devices designed and developed for steady state irradiation and ramp tests in a flowing boiling water environment are described. The SHUFFLING device operates in hot cells with the objective of detecting, after an irradiation period, defective rod bundles and performs the shuffling of three rod bundles. Defect detection is based on thermal and pressure cycling of the fuel. The DIC device is for the nondestructive detection of fretting corrosion marks on the pressure tube surface in contact with the fuel. The basic principle is the permanent reproduction of the inside surface on a special rubber material. The PROBA in cells device allows for tangential strain evaluation of irradiated fuel cladding by the experimental measurement of the actual cladding profile in polar coordinates. Author (ESA)

74 OPTICS

Includes light phenomena.

N81-24900* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FLUORESCENT RADIATION CONVERTER Patent
Walter Viehmann, inventor (to NASA) Issued 14 Apr. 1981 9 p Filed 11 Jan. 1980 Supersedes N80-18261 (18 - 09, p 1125)
(NASA-Case-GSC-12528-1; US-Patent-4,262,206; US-Patent-Appl-SN-111439; US-Patent-Class-250-483; US-Patent-Class-250-368) Avail: US Patent and Trademark Office CSCL 20F

A fluorescence radiation converter is described which includes a substantially undoped optically transparent substrate and a waveshifter coating deposited on at least one portion of the substrate for absorption of radiation and conversion of fluorescent radiation. The coating is formed to substantially 1000 g/liter of a solvent, 70 to 200 g/liter of an organic polymer, and 0.2 to 25 g/liter of at least one organic fluorescent dye. The incoming incident radiation impinges on the coating. Radiation is absorbed by the fluorescent dye and is re-emitted as a longer wavelength radiation. Radiation is trapped within the substrate and is totally internally reflected by the boundary surface. Emitted radiation leaves the substrate ends to be detected.
Official Gazette of the U.S. Patent and Trademark Office

N81-24901 Minnesota Univ., Minneapolis.
INFRARED DETECTION WITH POINT CONTACT-METAL SEMICONDUCTOR DIODES Ph.D. Thesis
Gadi Eisenstein 1980 197 p refs
Avail: Univ. Microfilms Order No. 8109420

Point contact Schottky barrier diodes, operating as video detectors and harmonic mixers at infrared frequencies, are studied, and theoretical models are developed and tested. A model extending the frequency response of the nonlinear barrier into the infrared is developed. Conductive and capacitive detection in highly doped semiconductors is considered. A model in which the low frequency spreading resistance is replaced by a complex spreading impedance is developed. The model predicts that optimal operation requires a semiconductor whose plasma frequency is one-third the operation frequency. Physical processes taking place simultaneously in the active region and in general thermal in nature are investigated. A thermo-electric detection model is developed and confirmed experimentally. The manufacturing of bulk point contact diodes is described in detail. Experimental results are compared with theoretical predictions. A method for producing thin crystaline semiconducting films on a metallic substrate is described. Dissert. Abstr.

N81-24902 California Univ., Santa Barbara.
SPATIAL FREQUENCY CHARACTERISTICS OF OPTO-ACOUSTIC TRANSDUCERS Ph.D. Thesis
Behzad Noorbehesht 1980 173 p
Avail: Univ. Microfilms Order No. 8108368

The resolution of opto-acoustic transducers (OATs) is characterized. The structure consists of a piezoelectric layer and a photoconductive layer sandwiched between two electrode layers. The OAT provides an optically controlled, scanning focused beam of ultrasound which can be used to obtain an acoustical image of an object in water. One measure of effectiveness of an OAT as a focused ultrasonic transducer is its inherent resolution. This is determined by the sharpness of the acoustical focal-spot generated by the device. This may be determined by obtaining its spatial transfer function. To obtain the spatial transfer function of an OAT, the behavior of elastic waves at the boundary between several piezoelectric materials and water was studied. The piezoelectric layer's transfer function was found to adequately represent the aberration-limited transfer function of the device as a whole. However this transfer function is affected by the presence of the photoconductive backing layer. By comparing aberrations and diffraction effects, optimum OAT size and the corresponding maximum resolution are determined.
Dissert. Abstr.

N81-24903 Illinois Univ. at Urbana-Champaign.
THE MASLOV METHOD AND THE ASYMPTOTIC FOURIER TRANSFORM: CAUSTIC ANALYSIS Ph.D. Thesis
Richard Walter Ziolkowski 1980 448 p
Avail: Univ. Microfilms Order No. 8108715

It is known that the representation of a high frequency field by geometrical optics fails in the vicinity of a caustic. Among several solutions to this problem, a systematic approach due to Maslov consists essentially of operating in the phase-space M (position-wavevector) instead of the space X(position). A flow which characterizes the system is defined in M by Hamilton's equations. The flow lines, or phase-space rays, are projected on X along the rays of geometrical optics. Dissert. Abstr.

N81-24904 Rensselaer Polytechnic Inst., Troy, N. Y.
IMAGE SCANNING AND SIGNAL PROCESSING USING SURFACE ACOUSTO-OPTIC INTERACTION Ph.D. Thesis
Mohammed Ayub-Faithimulla 1980 205 p
Avail: Univ. Microfilms Order No. 8109307

The surface acousto-optic (SAO) interaction was successfully employed in a variety of applications such as convolution, correlation, Fourier transformation in real time, and image scanning. The theory of interaction of SAW with the coherent Gaussian beam is developed using the diffractional integral, which is eventually extended to uniform light. Two dimensional image scanning of black and white movies is performed. The system is extended to the scanning of one and two dimensional color transparencies. The modulation transfer function for the image scanner is derived and the limit of resolution is obtained from it. Dissert. Abstr.

N81-24905 Oregon Graduate Center for Study and Research, Beaverton.
PHOTON COUNTING RECEIVERS FOR OPTICAL COMMUNICATION THROUGH THE TURBULENT ATMOSPHERE Ph.D. Thesis
Kaliappan Shanmuganathan 1980 216 p
Avail: Univ. Microfilms Order No. 8109793

Spatial diversity arrays to overcome the effect of fading due to atmospheric turbulence are considered. Experimental results are compared with theoretical results for an optimum receiver structure based upon Bayes criterion of minimum probability of error. In addition, certain suboptimum receivers with simple structures are derived directly from the optimum receiver. These receivers, along with an adaptive threshold receiver are considered in order to examine the tradeoff between performance and complexity. The rsults indicate that the adaptive threshold receiver is a good compromise for information rates that are high with respect to scintillation frequencies, a relatively unrestrictive condition. Dissert. Abstr.

N81-24906 Oregon Graduate Center for Study and Research, Beaverton.
ELECTROOPTIC STREAK CAMERA Ph.D. Thesis
John Basil Shaw 1980 155 p
Avail: Univ. Microfilms Order No. 8109790

A number of electrooptic techniques were utilized to provide beam deflection, but, as shown here, they are all subject to limitations imposed by transit time of light through the device. These limitations may be overcome, however, by suitably combining a number of simple deflectors to form a strip transmission line which can provide a synchronous interaction between an electrical pulse and the optical pulse to be displayed. Unfortunately, the existence of a suitable deflection technique does not immediately guarantee the development of a practical electrooptic streak camera; major difficulties exist in the production of an acceptable voltage pulse generator. Laser triggered spark gaps are the best alternative, and utilizing one of these, the first demonstration of deflection technique was accomplished. Although the results have been less than dramatic, the best resolution time obtained being only 750 picoseconds, they show that it should be possible to construct an electrooptic streak camera providing better than 10 picosecond resolution in the near infrared. Dissert. Abstr.

N81-24907*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APPARATUS FOR FIBER OPTIC LIQUID LEVEL SENSING Patent Application
Madan Sharma, inventor (to NASA) (TRW, Inc., Redondo Beach, Calif.) Filed 19 Feb. 1981 15 p Sponsored by NASA
(NASA-Case-MSC-18674-1; US-Patent-Appl-SN-235363) Avail: NTIS HC A02/MF A01 CSCL 20F

A liquid level sensor particularly adapted for use in cryogenic systems is described. It is in the form of a sawtooth-shaped unclad optical fiber and has two liquid contacting points and a scatter-producing bend at least in an input leg of the optical fiber, to increase sensitivity. A pulsed light emitting diode (LED) energizes the sensor input leg through a connecting optical fiber and a second connecting optical fiber conveys light pulses passing through the sensor to a photodiode. The photodiode develops an electrical signal which is a function of attenuation through the sensor, the latter being greatest when the sensor contacting points are in physical contact with the liquid. Processing of the pulsed photodiode output is effected in an amplifier synchronously enabled during the occurrence of the LED pulses.
NASA

N81-24908*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE RETARDING ION MASS SPECTROMETER ON DYNAMICS EXPLORER-A
C. R. Chappell, S. A. Fields, C. R. Baugher, J. H. Hoffman, W. B. Hanson, W. W. Wright, H. D. Hammack, G. R. Carignan, and A. F. Nagy Apr. 1981 26 p refs Prepared in cooperation with Texas Univ. at Dallas, Richardson and Michigan Univ., Ann Arbor
(Contract NAS8-32831)
(NASA-TM-82418) Avail: NTIS HC A03/MF A01 CSCL 20F

An instrument designed to measure the details of the thermal plasma distribution combines the ion temperature-determining capability of the retarding potential analyzer with the compositional capabilities of the mass spectrometer and adds multiple sensor heads to sample all directions relative to the spacecraft ram directions. The retarding ion mass spectrometer, its operational modes and calibrationn are described as well as the data reduction plan, and the anticipated results. A.R.H.

N81-24909# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
FAST SWITCHES FOR OPTICAL COMMUNICATION UTILIZING OPTICAL KERR OR ELLIPSE ROTATION EFFECT Final Technical Report, 1 Oct. 1977 - 30 Sep. 1979
Richard K. Chang Griffiss AFB, N.Y. RADC Mar. 1981 74 p refs
(Contract F19628-78-C-0021; AF Proj. 0176)
(AD-A098268; RADC-TR-80-87) Avail: NTIS HC A04/MF A01 CSCL 09/3

This report summarizes the results of an investigation of several different types of optically activated light switches based on third-order nonlinear optical effects. Two optical switches utilizing the change of refractive index induced in a nonlinear medium by an intense light beam are described: one utilizes a single-pass and the other a multiple-pass (interferometric) geometry. Results of a search to find new media with large nonlinearities are given, and the possibility of increasing the nonlinearity of commonly used media by Raman-type resonant enhancement is discussed. The theoretical and experimental behavior of Fabry-Perot interferometer switch with a nonlinearly absorbing intracavity medium is also presented. In some cases, the switch could be activated by anomalously low pump powers, and possible mechanisms for this effect are discussed. The results of a literature search on the photorefractive effect are presented along with the results of an experimental effort to measure the photorefractive effect in Ge:SiO2. Author (GRA)

N81-24910# Stanford Univ., Calif. Physics Lab.
ACOUSTICALLY SCANNED OPTICAL IMAGING DEVICES Annual Technical Report, 1 Jul. 1975 - 14 Nov. 1980
G. S. kino, J. Bowers, R. Thornton, and B. Khuri-Yakub Feb. 1981 47 p refs
(Contract N00014-76-C-0129; ARPA Order 2778)
(AD-A098162; GL-3219; ONR-243-034-11) Avail: NTIS HC A03/MF A01 CSCL 17/1

A number of new ZnO based monolithic acoustoelectric devices have been demonstrated during the past three years, including Sezawa wave convolvers and storage correlators with 36 MHz bandwidth, Rayleigh wave Schottky diode and p-n diode storage correlators, and GaAs convolvers operating in a nonlinear resistive mode. These devices have been demonstrated in chirp and PSK compression experiments. A new, extremely fast SAW based adaptive filter was demonstrated in a variety of experiments, including echo suppression, spurious signal suppression, and impulse response improvement of a bulk wave transducer. A reactive magnetron sputtering system was constructed, and the optimum deposition parameters were determined. ZnO films were deposited at extremely high rates (10 - 20 microns/hour), and excellent orientation is routinely obtained (FWHM of (0002) peak 5.3 deg). Author (GRA)

N81-24911# Hughes Research Labs., Malibu, Calif.
FIBER OPTIC COUPLERS Final Technical Report, 1 Aug. 1978 - 31 Aug. 1980
Gregory L. Tangonan Jan. 1981 70 p
(Contract F19628-78-C-0201; AF Proj. 4600)
(AD-A097763; RADC-TR-80-358) Avail: NTIS HC A04/MF A01 CSCL 20/6

A planar technology has been developed for fabrication of passive couplers for use in multimode fiber optics. Ion exchange from fused electrolytes has been used for waveguide fabrication using photolithography for pattern definition. Techniques are described for optimizing the throughput of the coupling device when terminated with commercial multimode optical fibers. Couplers have been fabricated in T, Y and star configurations. Author (GRA)

N81-24912# Hughes Aircraft Co., Culver City, Calif. Image Processing Lab.
ATAC AUTOCUER MODELING ANALYSIS Final Report
R. L. Frey, C. .D. Nealy, L. M. Rubin, and R. M. Wilkox Jan. 1981 127 p refs
(Contract DAAK70-77-C-0232)
(AD-A097723; HAC-FR-80-70-1325) Avail: NTIS HC A07/MF A01 CSCL 12/1

An analytic modeling approach for image processing algorithms has been developed and applied to the complex object segmentation operation used for target classification/recognition in flir images. Author (GRA)

N81-24913# Optical Sciences Co., Placentia, Calif.
ANALYSIS OF ADVANCED C. APPLICATION Final Technical Report, Apr. - Oct. 1980
David L. Fried Griffiss AFB, N.Y. RADC Mar. 1981 69 p refs
(Contract F30602-79-C-0062; ARPA Order 2646)
(AD-A098105; DR-186; RADC-TR-81-13) Avail: NTIS HC A04/MF A01 CSCL 17/8

This report is the last of three technical reports prepared on this contract. It treats two subjects. The first subject is the effect of daylight background on CIS operation. It is concluded that such operation should be feasible and yield acceptable performance for all but the faintest targets of nominal interest to the CIS. The analysis is concerned with shot noise limits and assumes that all matters that could be classified as alignment or adjustment of the system have been properly aligned or adjusted. The second subject is concerned with the definition of a practical form for an UpLink adaptive optics laser transmitter experiment. The critical features of a ground to aircraft and a ground to space experiment are identified, implementation approaches are suggested, and magnitude of relevant parameters are determined. GRA

N81-24914# Rockwell International Science Center, Thousand Oaks, Calif. Microelectronics Research and Development Center.
INTEGRATED OPTICAL TRANSMITTER AND RECEIVER Status Report, 18 Sep. - 31 Dec. 1980
P. D. Dapkus 1980 4 p
(Contract N00173-80-C-0485; ARPA Order 4036)
(AD-A098272; MRDC41081.1RD; SR-1) Avail: NTIS HC A02/MF A01 CSCL 17/2

Most of the effort during this quarter was devoted to the development of the diffusion process required for the TJS laser and to definition of epitaxial growth and process requirements to achieve the program goals. During this reporting period, deep Zn diffusion process for producing a transverse junction in the proposed laser structure was studied and developed. GRA

N81-24915# Kansas State Univ., Manhattan. Dept. of Physics.
TIME-RESOLVED OPTICAL TRANSMISSION OF PULSED LASER-IRRADIATED SILICON
M. C. Lee, H. W. Lo, A. Aydinli, and A. Compaan 2 Oct. 1980 12 p refs Submitted for publication
(Contract N00014-18-C-0419)
(AD-A098217) Avail: NTIS HC A02/MF A01 CSCL 20/6

The time-resolved optical transmission of silicon has been observed at lambda = 1.15 microns during irradiation by an 8 nsec pulsed laser at 485 nm with several energy densities in the range of .25 to 1.2 J/sq cm. The transmission exhibits a sudden brief drop consistent with the rise and fall of the reflectivity enhancement. However, the transmission does not exhibit the strong absorption expected of molten silicon with a skin depth of approx. 100A. Author (GRA)

N81-24916# Princeton Univ., N. J. Joseph Henry Labs.
CRITERIA FOR EVALUATION OF LOW LIGHT LEVEL INTENSIFIERVIDICON DETECTORS FOR MICROSCOPY AND SPECTROSCOPY
George T. Reynolds Aug. 1980 28 p refs Presented at the 20th. ASCB Ann. Meeting, Cincinnati, 15 Nov. 1980
(Contract DE-AS02-76EV-03120)
(DOE/ET-03120/25; CONF-801174-1; TR-24) Avail: NTIS HC A03/MF A01

The growing use and commercial availability of intensified TV detectors for biological research makes it important to have meaningful criteria for system evaluation and comparison. Several methods that are readily achieved in laboratory practice are described for such evaluations. These procedures are equally applicable to image intensified spectroscopy. DOE

N81-24917# Los Alamos Scientific Lab., N. Mex.
FAST TRANSIENT ABSORPTION IN OPTICAL FIBERS
P. B. Lyons, L. D. Looney, and R. E. Kelly 1981 5 p refs Presented at the IOOC '81, San Francisco, 27-29 Apr. 1981 (Contract W-7405-eng-36)
(LA-UR-80-3348; CONF-810407) Avail: NTIS HC A02/MF A01

Transient absorption in optical fibers was studied with 2 ns resolution. The data show a very fast absorption peak (with little temperature dependence) superimposed on a slow, temperature dependent, recovery. DOE

N81-24918# Rockwell International Science Center, Thousand Oaks, Calif. Microelectronics Research and Development Center.
INTEGRATED OPTICAL TRANSMITTER AND RECEIVER Status Report, 1 Jan. - 31 Mar. 1981
P. D. Dapkus 1981 6 p
(Contract N00173-80-C-0485; ARPA Order 4036)
(AD-A098273; MRDC41081.2RD; SR-2) Avail: NTIS HC A02/MF A01 CSCL 12/2

Chip layout of electronic driver circuits utilizing TELD's, FET's, and resistors were completed. Six driver configurations were designed into a unit cell to anticipate diode laser threshold prebias currents of 40 to 150 mA and modulation currents approximately 0.2 I subscript to 3I subscript t depending on the driver and laser threshold combination. The electronic driver was designed to be compatible with a TJS, diffused-stripe, or other laser structure grown in an etched groove in the S. I. GaAs substrate for planar electronic driver processing. Generalized processing steps for the fabrication of planar integrated transmitter structures were formulated. The feasibility of key planar processing steps were demonstrated. Growth of MO-CVD into an etched groove in S. I. GaAs with subsequent etch processing to yield a planar surface was demonstrated. This groove growth verifies the capability of achieving planar GaAlAs/GaAs/GaAlAs laser structures in S. I. GaAs. Selective implantation rather than epitaxial techniques used to fabricate electronic devices offer the advantages of (1) higher performance (eliminating the deleterious effects of grown interface), (2) greater control and reproducibility, and (3) compatibility with planar processing techniques. Sulfur implanted/diffused Gunn devices with higher current drop ratios at lower nt products than epitaxial counterparts were reported. GRA

N81-24919# Fondazione Ugo Bordoni, Rome (Italy).
RAY FORMALISMS IN CLASSICAL OPTICS [FORMALISMO DEI RAGGI IN OTTICA CLASSICA]
Salvatore Solimeno (Naples Univ.), Bruno Crosignani, and Paolo DiPorto Dec. 1979 60 p refs In ITALIAN Sponsored in part by CNR
(FUB-31-1979) Avail: NTIS HC A04/MF A01

A mathematical analysis of ray optics is presented. Wave propagation equations are analyzed. An asymptotic solution of the wave equation is given, using the eikonal equation, the ray equation, the transport equation of the field, and the U sub M transport equation. The differential properties of wave fronts are analyzed, and wave fronts in homogeneous masses and the refraction and reflection of wave fronts examined. Scalar equations of rays of curvilinear coordinates are given. Fresnel's formulas for reflection and refraction in surface planes are explained.
Transl. by J.D.H.

N81-24920# Agfa-Gevaert A.G., Munich (West Germany). Entwicklung Optik.
FAST LENSES MADE OF PLASTIC Final Report
Otfried Renner Bonn Bundesministerium fuer Forschung und Technologie Oct. 1980 91 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-104; ISSN-0340-7608) Avail: NTIS HC A05/MF A01

The physical and technological requirements for manufacturing highly sensitive lenses from glass-plastic compounds were determined. Laboratory prototypes were produced. Their aspherical characteristics are elucidated. The calculation of optical properties (refractive index) for plastic materials is discussed. The measurement of spherical and aspherical surface topography is described. Lens behavior under climatic testing is treated. Results lead to the definition of a precise molding technique for plastic lens elements. Author (ESA)

N81-24131*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A LOW LIGHT LEVEL TELEVISION SYSTEM
B. J. Duncan *In its* Proc. of the Shuttle-Based Cometary Sci. Workshop 1976 p 93-93 (For primary document see N81-24128 15-12)
Avail: NTIS HC A12/MF A01 CSCL 20F

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N81-24921 Stanford Univ., Calif.
PLASMA DOUBLE-LAYERS Ph.D. Thesis
Jerrold Steven Levine 1981 138 p refs
Avail: Univ. Microfilms Order No. 8108963

The space charge double-layer that forms between two plasmas with different densities and thermal energies is described. Three progressively more realistic models are treated by fluid theory taking into account four species of particles: electrons and ions reflected by the double-layer, and electrons and ions transmitted through it. Langmuir probe measurements were carried out which conform the occurrence of double-layers in an argon positive column. Pulsing the discharge current permits probe measurements to be performed in the presence of the double-layer. The double-layer that forms due to ponderomotive effects produced by a convectively amplifying electron beam plasma interaction was analyzed. The model takes account of finite plasma electron temperature and electron neutral collision frequency. A double layer forms in the region where the instability saturates.
Dissert. Abstr.

N81-24922 Illinois Univ. at Urbana-Champaign.
IODINE-MONOFLUORIDE (IF) EMISSION SPECTRUM AND FORMATION KINETICS IN ELECTRON BEAM PRODUCED PLASMAS Ph.D. Thesis
Sheldon Butt Hutchison 1980 76 p
Avail: Univ. Microfilms Order No. 8108551

Electron beam excitation of argon/CF3I/NF3 gas mixtures produces intense blue-green fluorescence attributed to the heteronuclear interhalogen iodine-monofluoride (IF). Fluorescence decay measurements indicate that the I(4P) species is the IF(E) precursor, and that the observed fluorescence decay rates are controlled by deactivation of this excited iodine species. Collisional deactivation rate coefficients of I(4P) by argon, xenon, CF3I, NF3, and UF6 were measured and are reported. Mathematical modelling of the IF fluorescence pulse suggests that the effective lifetime of the I(4P) species increases with time during the pulse due to radiative trapping of atomic iodine emission. Discharge pumped IF laser experiments are also described.
Dissert. Abstr.

N81-24923 Texas Univ. at Arlington.
AN INVESTIGATION OF RUNWAY ELECTRONS IN THE PRETEXT TOKAMAK Ph.D. Thesis
Stephen Alan Eckstrand 1980 122 p
Avail: Univ. Microfilms Order No. 8109157

High energy runaway electrons in PRETEXT discharges are studied by detecting the hard X-ray bremsstrahlung radiation produced when they escape from the discharge and strike the limiter. A pulse height analysis system, which included pile-up rejection circuitry because of the hgih count rate, recorded both the amplitude and arrival time of each pulse. Early runaway

electrons occur in only some of the discharges, and these are lost during the current buildup phase of the discharge. A second phase of runaway production begins during the early part of the current plateau phase, when the temperature has reached its peak, but the density is still low. These runaways accelerate at nearly the free fall rate to energies of 2.5 - 3.0 MeV. The confinement of these electrons is in good qualitative agreement with the collisionless single-particle orbit model. A series experiments in which the pressure was varied and agreed qualitatively quite well with classical runaway production theory. Dissert. Abstr.

N81-24924 Princeton Univ., N. J.
EXPERIMENTAL INVESTIGATION OF AN IMPURITY-DRIVEN DRIFT-WAVE INSTABILITY Ph.D. Thesis
Gary Robert Allen 1981 82 p
Avail: Univ. Microfilms Order No. 8111274

An impurity driven drift wave instability is observed to be destabilized by the reversed density gradient of a heavy, single ionized impurity ion population in a Q-machine plasma. The dispersion relation is derived from the Vlasov equation, including collision. The dependences of frequencies and growth rates upon azimuthal mode number, magnetic field, and impurity fraction are all in good agreement with the local, linear, slab model dispersion relation. By pulsing the impurity ion injection, the evolution of the instability is investigated through the linear exponential growth phase, into nonlinear saturation, whereupon strong, radially outward anomalous diffusion is driven by a wave particle interaction. The relationship between the anomalous diffusion coefficient and the wave amplitude strongly supports some aspects of the nonlinear drift wave turbulence theory. The experimental results verify the minimum fluctuation level required for drift wave induced transport which results from the onset of transverse trapping of the ions by the wave electric field. In the strong turbulence limit, the anomalous diffusion coefficient is proportional to the normalized wave amplitude. Dissert. Abstr.

N81-24925*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANNIHILATION RADIATION FROM A HOT e(+)-e(-) PLASMA
R. Ramaty and P. Meszaros (Maryland Univ., College Park) Apr. 1981 25 p refs Submitted for publication
(NASA-TM-82124) Avail: NTIS HC A02/MF A01 CSCL 20I

Pair annihilation in hot e(+)-e(-) plasmas is studied. The annihilation rate, luminosity and spectrum of optically thin plasmas of temperatures above 10 to the 8th power K are calculated by means of a Monte Carlo simulation. For a given temperature, the spectrum is peaked at an energy equal to 0.511 MeV plus a positive definite quantity of order kT. In high temperature sources, such as gamma ray bursts, this blue shift can amount to a significant fraction of 0.511 MeV. The annihilation line is also temperature broadened. The width varies as T to the 1/2 power for kT much less than 0.511 MeV, and as T for kT much greater than 0.511 MeV. The widths of the 400 to 460 keV emission lines observed from several gamma ray bursts set limits on the temperatures of the pair annihilation region in burst sources. The burst emission is either nonthermal or the pair annihilation region is spatially distinct from the site of the outburst itself. J.D.H.

N81-24926*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CONCEPTUAL DESIGN OF THE MHD ENGINEERING TEST FACILITY
D. J. Bents, R. W. Bercaw, J. A. Burkhart, T. S. Mroz, H. S. Rigo, C. V. Pearson (Argonne National Lab., Ill.), D. K. Warinner (Argonne National Lab., Ill.), A. M. Hatch (MIT, Cambridge), M. Borden (Gilbert Associates, Inc., Reading, Pa.), D. A. Giza (Gilbert Associates, Inc., Reading, Pa.) et al 1981 15 p refs Presented at the 19th Symp. on Eng. Aspects of Magnetohydrodyn., Tullahoma, Tenn., 15-17 Jun. 1981
(Contracts DE-AI01-77ET-10769; EF-77-A-01-2674)
(NASA-TM-82621; DOE/NASA/10769-18; E-872) Avail: NTIS HC A02/MF A01 CSCL 20I

The reference conceptual design of the MHD engineering test facility, a prototype 200 MWe coal-fired electric generating plant designed to demonstrate the commerical feasibility of open cycle MHD is summarized. Main elements of the design are identified and explained, and the rationale behind them is reviewed. Major systems and plant facilities are listed and discussed. Construction cost and schedule estimates are included and the engineering issues that should be reexamined are identified. A.R.H.

N81-24927*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A MHD CHANNEL STUDY FOR THE ETF CONCEPTUAL DESIGN
S. Y. Wang, P. J. Staiger, and J. Marlin Smith 1981 13 p refs Presented at the 19th Symp. on Eng. Aspects of Magnetohydrodyn., Tullahoma, Tenn., 15-17 Jun. 1981
(Contract DE-AI01-77ET-10769)
(NASA-TM-81764; DOE/NASA/10769-14; E-827) Avail: NTIS HC A02/MF A01 CSCL 20I

The procedures and computations used to identify an MHD channel for a 540 mW(l) EFT-scale plant are presented. Under the assumed constraints of maximum E(x), E(y), J(y) and Beta; results show the best plant performance is obtained for active length, L is approximately 12 M, whereas in the initial ETF studies, L is approximately 16 M. As MHD channel length is reduced from 16 M, the channel enthalpy extraction falls off, slowly. This tends to reduce the MHD power output; however, the shorter channels result in lower heat losses to the MHD channel cooling water which allows for the incorporation of more low pressure boiler feedwater heaters into the system and an increase in steam plant efficiency. The net result of these changes is a net increase in the over all MHD/steam plant efficiency. In addition to the sensitivity of various channel parameters, the trade-offs between the level of oxygen enrichment and the electrical stress on the channel are also discussed. A.R.H.

N81-24928# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF PLASMA: SURFACE INTERACTIONS ON SELECTED CONDUCTORS AND INSULATORS M.S. Thesis
Joseph Henry Barker and Robert Jacque Rush Dec. 1980 108 p refs
(AD-A098084) Avail: NTIS HC A06/MF A01

Damage caused by plasma surface interactions is of concern in fields involving the use of such plasma devices as particle beam weapons, high power lasers and controlled thermonuclear fusion reactors. Several conductors and nonconductors were exposed to a plasma to study the plasma surface interaction damage. In one part of the study, the plasma was induced by irradiating the surface of the samples with a Q switched neodymium laser. Some of the samples were irradiated in air, at atmospehric pressure, and in a vacuum, to compare the difference in the extent of the damage on the same types of samples at different pressures. In the other part of the study, several titanium coated conductors and titanium coated nonconductors were exposed to the plasma of a Tokamak. Both the metal conductors in the first part of the study, and the titanium coatings in the second part of the study, were damaged by unipolar arcing. Nickel showed less evidence of unipolar arcing damage than any of the other samples studied. GRA

N81-24929# Naval Research Lab., Washington, D. C.
FAST ION STOPPING POWER IN DENSE, IONIZED PLASMAS Interim Report
J. E. Rogerson 17 Apr. 1981 41 p refs
(AD-A097772; NRL-MR-4485) Avail: NTIS HC A03/MF A01 CSCL 20/8

A model is presented for calculating stopping cross sections for ions in ionized plasma targets. This approach utilizes a local oscillator model to calculate stopping power by bound electrons. Results obtained from this formulation are presented and compared with other calculations. Author (GRA)

N81-24930# Naval Research Lab., Washington, D. C. Lab. for Computational Physics.
A FULLY TWO DIMENSIONAL EQUILIBRIUM AND TRANSPORT MODEL OF THE POLOIDAL DIVERTOR Interim Report
M. H. Emery and N. K. Winsor 2 Apr. 1981 86 p refs
(Contracts EX-76-A-34-1006; DE-TR01-80ET-53020)

(AD-A098123; NRL-MR-4498) Avail: NTIS HC A05/MF A01 CSCL 20/9

We have developed a fully two-dimensional Eulerian-Lagrangian nonideal MHD simulation model of Tokamak discharges. The code is designed to simultaneously follow the resistive diffusion transport and gross dynamics of a magnetically confined plasma of arbitrary shape. It uses as a finite-difference mesh a general connectivity triangular grid. the triangular grid is the natural choice for a finite-difference mesh for modeling complicated geometries with interfaces, multiple magnetic axes and separatrices. We present here the methods we have developed to calculate equilibria and transport in a fully two dimensional geometry. The model is sufficiently general that is capable of calculating equilibria and transport given rather general plasma geometries and coil structures. Here we apply the model to the poloidal divertor system and describe the results. GRA

N81-24931# Spire Corp., Bedford, Mass.
TECHNIQUES FOR THE SIMULATION OF THE SPACE PLASMA ENVIRONMENT
Ward D. Halverson Hanscom AFB, Mass. AFGL Sep. 1980 46 p refs
(Contract F19628-80-C-0055; AF Proj. 7661)
(AD-A097734; SAR-FR-80-60024; AFGL-TR-80-0337; SR-2) Avail: NTIS HC A03/MF A01 CSCL 20/9

The effects of space plasmas with distributed spectra of particle energies can be simulated in the laboratory by combinations of monoenergetic electron and ion beams. The energy and current density of beams are calculated to provide piecewise reproduction of distributed spectra and by matching various moments of the velocity distribution functions of space plasmas. Analytical solutions for several cases have been found to simulate Maxwellian and two Maxwellian distribution functions. Spacecraft charging by geomagnetic substorm plasmas and combinations of monoenergetic beams is compared qualitatively using a simple model. We find similar charging characteristics for the plasmas and a few beams specified by the moment matching techniques. Author (GRA)

N81-24932# Wisconsin Univ., Madison.
MEASUREMENTS OF LOW ENERGY HYDROGEN ION EFFECTIVE STICKING COEFFICIENTS ON TITANIUM IN THE WISCONSIN LEVITATED OCTUPOLE
H. Garner and R. S. Post Feb. 1981 22 p refs
(Contract DE-AS02-76ET-53051)
(DOE/ET-53051/19) Avail: NTIS HC A02/MF A01

The effective sticking coefficient for low energy (< 30 eV) hydrogen ions on titanium gettered aluminium walls was measured in the Wisconsin Levitated Octupole. A value of greater than 0.75 was measured. The H2 effective sticking coefficient for the same conditions is less than 0.01. Seventy-four percent of the wall area of the Octupole is gettered. The effects of recycling on plasma parameters is also discussed. DOE

N81-24933# Wisconsin Univ., Madison. Dept. of Physics.
OBSERVATIONS OF q > 1 DISCHARGES IN TOKAPOLE 2
T. H. Osborne, R. N. Dexter, and S. C. Prager Jan. 1981 17 p refs
(Contract DE-AS02-76ET-53051)
(DOE/ET-53051/17) Avail: NTIS HC A02/MF A01

Observations are reported of discharges in which safety factor q values are obtained as low as 0.4 in Tokapole 2, a Tokamak with a four-node poloidal divertor configuration. DOE

N81-24934# Wisconsin Univ., Madison.
ALFVEN WAVE HEATING STUDIES IN TOKAPOLE 2
F. D. Witherspoon, C. E. Kieras, J. C. Sprott, and S. C. Prager Dec. 1980 8 p refs Presented at the 4th Topical Conf. on Radio Freq. Plasma Heating, Austin, Tex., 9-10 Feb. 1981
(Contract DE-AS02-76ET-53051)
(DOE/ET-53051/16; CONF-810214-1) Avail: NTIS HC A02/MF A01

Coupling to shear Alfven wave resonances as a promising heating scheme for Tokamaks is experimentally investigated in Tokapole 2. Resonances in the poloidal magnetic wave field were observed during the RF pulse with resonant peaks on both sides of the separatrix. The location and mode structure of these peaks are consistent with theoretical calculations for the noncircular Tokamak plasma indicating the strong possibility that shear Alfven wave resonances are being observed in a Tokamak geometry. DOE

N81-24935# California Univ., Livermore. Lawrence Livermore Lab.
EFFECT OF RE-HEATING ON THE HOT ELECTRON TEMPERATURE
K. Estabrook and M. Rosen 17 Jun. 1980 11 p refs
(Contract W-7405-eng-48)
(UCID-18712) Avail: NTIS HC A02/MF A01

Resonant absorption is discussed wherein the transverse laser light is converted to longitudinal electron plasma waves (epw) at the critical density 10 to the 21st power (1.06 mu m/lambda 0) (2) cm (-3). The oscillating longitudinal electric field of the epw heats the electrons by accelerating them down the density gradient. The effects of magnetic fields and collisions (albedo) which return the heated electrons for further heating are studied. A magnetic field increases their temperature and collisions do not. DOE

N81-24936# Hanford Engineering Development Lab., Richland, Wash.
MATERIALS HANDBOOK FOR FUSION ENERGY SYSTEMS
30 Apr. 1980 43 p
(Contract DE-AC14-76FF-02170)
(DOE/TIC-10122) Avail: NTIS HC A03/MF A01

A readily available source of data is provided to those involved in the design and analysis of fusion reactors or their components. Specific emphasis is placed on materials properties necessary for the design and analysis of the first wall and blanket structure of both near and long term fusion reactor concepts. DOE

N81-24937# Oak Ridge Gaseous Diffusion Plant, Tenn. Computer Sciences Div.
FORMATION AND COLLISION OF ISOTHERMAL SHOCK WAVES IN A TORUS
James E. Park Feb. 1981 50 p refs
(Contract W-7405-eng-26)
(K/CSD/TM-41) Avail: NTIS HC A03/MF A01

The implict-compressible-Eulerian (ice) method for compressible transient flows is extended to model the case of a toroidal shock tube. A section of the tube is sealed with diaphragms and filled with high pressure gas. As the calculation starts, the diaphragms are removed and the gas rushes through the torus. Eventually the high speed fronts collided and reflect, reversing the flow in the torus. The ICE algorithm and its extension are briefly described. Calculated shock shapes in the toroidal tube are presented for an initial density ratio or 3.0. Comparison is made with the analytic theory. DOE

N81-24938# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
THE FOURIER TRANSFORM OF A FUNCTION RELATED TO THE PLASMA DISPERSION FUNCTION
A. E. P. M. Abels-vanMaanen Sep. 1980 31 p refs Sponsored by EURATOM and Nederlanse Organisatie voor Zuiver-Wetenschappelijk Onderzoek (ZWO)
(Rept-80-127) Avail: NTIS HC A03/MF A01

The Fourier transform F of the function Z (omega/modulus KV)/modulus KV is considered in reference to the theory of linearized waves in a hot plasma having a Maxwellian velocity distribution. The term Z is the so-called plasma dispersion function, omega and k are the frequency and wave number of a wave, and v is the thermal velocity of the particle. A method for the numerical calculation of F is given, and F is tabulated for various complex values of omega(y), y being the variable in Fourier space. Graphs of F versus omega(y) are included to provide better insight into the behavior of F. Author (ESA)

N81-24939# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
STABLE OPERATION OF HIGH CURRENT GLOW DISCHARGES
B. Brandt Jul. 1980 15 p refs Sponsored by EURATOM

and Nederlandse Organisatie voor Zuiver-Wetenschappelijk Onderzoek (ZWO)
(Rept-80-125) Avail: NTIS HC A02/MF A01

The cleaning of large Tokamak vessels with glow discharges as a source of H atoms is discussed, drawing on industrial experience in their use for the improvement of metal surfaces. Glow discharge is dealt with in relation to Townsend discharge and arcing. The stability of the glow is treated, and unipolar arcs, or cathode scintillations, are described. Similarity rules and scaling laws, used to predict the behavior of discharges when the size of the vessel or pressure are changed, are given. High temperature plasmas and cathode-fall are studied along with phenomena at the anode. The appropriateness of high current glow discharges to clean, to equalize, and to deoxidize plasma vessel surfaces is underlined. Author (ESA)

N81-24940# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
EXPERIMENTAL AND NUMERICAL STUDIES ON POTENTIAL DISTRIBUTIONS IN A PLASMA
N. Singh (Fraunhofer Inst.), R. Kist (Fraunhofer Inst.), H. Thiemann (Fraunhofer Inst.), and L. P. Block Apr. 1980 29 p refs Sponsored in part by Alexander von Humboldt Foundation
(TRITA-EPP-80-01; ISSN-0348-7539) Avail: NTIS HC A03/MF A01

Experimental results on the distribution of the electric potential in a plasma between two grids which are biased at constant potentials are reported. The plasma between the grids is injected from a source located on the low potential grid side. A common feature of the measured potential profile was a sheath near the low potential grid followed by a strong negative potential gradient. The experimental scheme was simulated numerically. The simulated potential profiles are qualitatively similar to the experimental ones. The simulation brought out the plasma processes involved in the formation of the steady state profiles. The important feature during the transient phase was seen to be the propagation of a solitary potential pulse, which was identified to be an electron hole, which propagated in the direction of electron drift with a velocity of the order of the electron thermal velocity. The reflection of the hole from the high potential grid led to the formation of the steady state profile.
Author (ESA)

N81-24941# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
MICROINSTABILITIES IN A RADIALLY CONTRACTING INHOMOGENEOUS CYLINDRICAL PLASMA SLAB
R. Deutsch and H. J. Kaeppler Jul. 1980 62 p refs
(IPF-80-9) Avail: NTIS HC A04/MF A01

The compression phase of the development of microinstabilities in a collapsing cylindrical plasma sheath is considered with respect to the situation in a zeta pinch or a plasma focus. Specifically, based on known experimental data from a plasma focus experiment, relations are established, then used in constructing a contracting cylindrical slab model. In contrast to previously used slab models, the orientation of the electric field is in the direction of the cylinder axis and the azimuthal magnetic field is induced by the current flowing through the cylindrical plasma slab. The model is employed in solving the Vlasov equation together with the Krook collision term for small perturbations, and in deriving the dispersion relation for microinstabilities, including the Maxwell equations. The results of this theory are seen as leading to a more general dispersion relation, taking into account runaway effects. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N81-24942 Kent State Univ., Ohio.
SPECIFIC HEAT IN THE VICINITY OF A NEMATIC-SMECTIC A-SMECTIC C MULTICRITICAL POINT Ph.D. Thesis
Richard John DeHoff 1980 165 p
Avail: Univ. Microfilms Order No. 8108749

The specific heat and transition temperature were measured in binary mixtures of 7bor S5 and 8 Bor S5 near a multicritical point where nematic, smectic A and smectic C phase coexist. The nematic to smectic C transitions remained first order as a function of concentration but displayed decreasing latent heats as the critical point was approached. The discontinuity of the pretransitional heat capacity remained constant as a function of concentration to within 1% of the critical point. A Ginzburg-like criterion for the nematic to smectic C transition which predicts a width of a critical region that was consistent with data. The nematic to smectic A transitions were second order and heat capacity data showed strong fluctuation effects both above and below the transition. In concentrations at distances further than 5% from the critical point, the heat capacity discontinuity of the smectic A to smectic C transitions remained relatively constant inside this range the discontinuity increased abruptly.
Dissert. Abstr.

N81-24943 Stanford Univ., Calif.
THE MONOLITHIC ZINC-OXIDE-ON-SILICON STORAGE CORRELATOR Ph.D. Thesis
Hsing Chien Tuan 1981 208 p
Avail: Univ. Microfilms Order No. 8109008

The fabrication process of the monolithic storage correlator is described. The general performance of the device is evaluated with special attention paid to the identification and reduction of spurious signals of the device. A complete theory of the operation of the monolithic storage correlator is given. The writing process is explained in detail by analyzing the charging characteristics of a PN-diode-capacitor system. The important of recombinations of minority carriers with majority carriers in the PN diodes is pointed out in the theoretical consideration and confirmed by experiments. A normal-mode analysis of the readout process giving the overall efficiency of the storage correlator is presented. A number of signal processing applications of the storage correlator are demonstrated with our monolithic structure. Operating in the output correlation mode, the storage correlator performs the function of a wideband programmable matched filter. The input correlation mode of operation allows the storage correlator to process signals several orders of magnitude longer than the acoustic length of the device, thus increasing the effective time-bandwidth product of the divice severalfold. Because of this unusual capability, emphasis is placed on the input correlation mode in our discussion. Dissert. Abstr.

N81-24944 Stanford Univ., Calif.
DETERMINATION OF THE EQUILIBRIUM SHAPES OF PLANAR DISLOCATION SHEAR LOOPS IN CUBIC CRYSTALS Ph.D. Thesis
Lane Abraham Gore 1981 111 p
Avail: Univ. Microfilms Order No. 8108934

The equilibrium shapes of planar dislocation shear loops in crystals cubic anisotropy are obtained utilizing advances in dislocation theory and numerical analysis. The criterion for equilibrium of the loop shapes in the current exposition is based upon the proper expression for the self force on an element of the loop. This expression, is shown to be the result of taking the first variation in the self energy OHM due to an arbitrary planar change in the configuration of an initially planar loop L. The major calculation needed in that expression involves computing the asymptotic stress behavior as one approaches an arbitrary planar loop. This behavior in numerically treated as a singular integral around the loop. A Semi-Nonlinear Continuous Spline is constructed and used for the evaluations of the loop's interpolating function, local tangents, and radio of curvature. The other numerical techniques involved, such as defining the shape of the loop as a 768-sided polygon, are described in detail. The qualitative and quantitave results for dislocating loops in isotropic and anisotropic media are given. Dissert. Abstr.

N81-24945 Stanford Univ., Calif.
PREPARATION AND PROPERTIES OF AlGaAs-GaAs DOUBLE HETEROJUNCTION DEVICES Ph.D. Thesis
Si-Chen Lee 1981 200 p
Avail: Univ. Microfilms Order No. 8108962

Double layer Au-(N)AlGaAs-(n)GaAs Schottky barrier (SB) devices were grown and their carrier transport properties investigated. The interaction of the closely spaced Au-AlGaAsSB

and the AsdGaAs heterojunction (HJ) was found to produce phenomenon termed band readjustment. This effect was used in the design of high efficiency solar cells. Criteria are presented by which the open circuit voltage and the short circuit current of the solar cells can be controlled separately. Dissert. Abstr.

N81-24946 Illinois Univ. at Urbana-Champaign.
LIQUID PHASE EPITAXIAL GROWTH AND LUMINESCENCE CHARACTERISTICS OF INDIUM GALLIUM PHOSPHIDE ARSENIDE-INDIUM PHOSPHIDE QUANTUM-WELL HETEROSTRUCTURES Ph.D. Thesis
Edward Anthony Rezek 1980 172 p
Avail: Univ. Microfilms Order No. 8108637

Single quantum-well quaternary (approximately 400A) heterostructures examined in electroluminescence are shown to exhibit stimulated emission at discrete energies corresponding to quantum mechanically allowed transitions between confined electron and heavy or light hole energy levels. The poor optical confinement characterizing such a thin layer and the decreased density of states in two dimensions are responsible for the high energy recombination shown to be typical of a single quantum well; bandfilling and stimulated emission are dmonstrated to occur up to approximately 160 meV above the lowest confined-particle transitions in the InGaPAs material. Thinner (approximately 150A) single-well heterostructures are not capable of normal carrier collection, and laser operation on confined-particle transitions is shown to be quenched. Photoexcited approximately 150A quantum wells do exhibit recombination between unbound electrons in the InP conduction band and bound holes at their allowed energy levels in the well. Dissert. Abstr.

N81-24947 Illinois Univ. at Urbana-Champaign.
THEORETICAL STUDIES OF HIGH FIELD TRANSPORT IN 3-5 SEMICONDUCTORS Ph.D. Thesis
Hisashi Shichuo 1980 170 p
Avail: Univ. Microfilms Order No. 8108657

Two theoretical aspects of high field transport in III-V semiconductors are discussed. A mechanism to obtain negative differential resistance in a GaAs-AlGaAs multilayered structure is described. The mechanism is based on the transfer of electrons in real space from a high mobility GaAs region to an adjacent low mobility AlGaAs region when a high electric field is applied parallel to the interface. It is analogous in many respects to the Gunn effect, except that this mechanism allows greater control of device characteristics. These characteristics can be adjusted by varying the doping densities, the layer thicknesses, and the Al mole fraction in the AlGaAs. The mechanism is analyzed using the electron temperature model and the Monte Carlo simulation. The electron temperature model is exact in the high carrier density limit, wheras the Monte Carlo method is valid in the low density limit. Both methods clearly illustrate the degree of control possible with this mechanism over device characteristics. Comparisons are made between the two models. Dissert. Abstr.

N81-24948 Colorado State Univ., Fort Collins.
THEORETICAL STUDY OF THE SILICON-SILICON DIOXIDE INTERFACE AND VALENCE BAND AUGER LINE SHAPES Ph.D. Thesis
Thampachen Kunjunny 1980 151 p
Avail: Univ. Microfilms Order No. 8110823

The electronic states and the valence band Auger spectra for the Si-SiO2 interface are theoretically calculated. A fully ordered interface with a thin layer of SiO2 on the Si(100) ideal surface is modeled and the electronic states are calculated with the slab method in the semi-empirical tightbinding formalism. The initial states of oxidation of the Si(100) surface are considered by studying both atomic and molecular chemisorption of oxygen on the Si(100) ideal surface. States which are typical of Si-O bonds are identified Characteristic peaks corresponding to these states appear in the Auger spectra. These appear between the Si peaks in bulk Si or SiO2. Dissert. Abstr.

N81-24949 Washington Univ., Seattle.
THE EFFECTS OF STRAIN ON THE SUPERCONDUCTING PROPERTIES OF NIOBIUM-TIN CONDUCTORS Ph.D. Thesis
Ronald Warren Hoard 1980 222 p
Avail: Univ. Microfilms Order No. 8109738

Analytic results obtained from a computer program (MAXIM-SUPER) which evaluates the three-dimensional strain fields on the Nb3Sn zones in a cylindrical repeating element of the composite due to both residual (thermal contraction) and applied axial loading are discussed. The code incorporates the calculated Nb3Sn strain values into appropriate scaling laws to predict the critical current density and its degradation with increasing axial strain. The connection between the cubic to tetragonal martensitic phase transformation and the phenomenon of superconductivity in Nb3Sn is investigated. Of particular interest is the degradation of the critical parameters with mechanical straining of the superconductor. Low temperature X-ray diffraction experiments were performed on Nb3Sn ribbons mounted to copper and indium sample stages. Results indicate that the martensitic phase transition temperature increases with increasing compressive strains. Experimental investigations on both the niobium core and bronze core geometries confirm the importance of the tangential strains on the critical current properties of the conductors. Dissert. Abstr.

N81-24950 Washington Univ., Seattle.
GENERALIZED RECURSION METHOD FOR SURFACE AND IMPURITY PROBLEMS Ph.D. Thesis
Daniel Martin Bylander 1980 125 p
Avail: Univ. Microfilms Order No. 8109717

Electronic properties of solids are described within a local, real space formalism, using a basis of localized, generalized Wannier functions (GWF) and a generalization of the 'recursion method'. In this approach, the traditional description of electronic structure, in terms of eigenstates, is replaced by one which focuses on the local environment. An ab initio, self consistent calculation of the electronic structure of a Cu(001) monolayer is presented, which demonstrates the practicality of the generalized recursion method. Special techniques introduced to optimize computational efficiency include: (1) the variational construction of optimal orbitals in a minimal subspace of local orbitals; (2) the use of interstitial orbitals; and (3) fitting schemes for the potential and charge density. The rapid convergence of the calculation to self consistency illustrates the computational practicality of the method and opens the possibility of treating other aperiodic systems. Dissert. Abstr.

N81-24951 Oregon Univ., Eugene.
DE HASS: VAN ALPHEN MEASUREMENTS IN ORDERED Cu3Au Ph.D. Thesis
Peter Paul Deimel 1980 158 p
Avail: Univ. Microfilms Order No. 8109672

An order-disorder transformation of Cu3Au at a temperature of 388oC develops and a simple cubic superlattice. The resulting new Fermi surface is completely different from the one in the disordered state. Three new pieces of the Fermi surface appear; a closed hole sheet in the second Brillouin zone (BZ), open electron sheets or jungle gyms in the third Brillouin zone, and closed noncentral electron sheets in the fourth Brillouin zone. The shape of the Fermi surface obtained from measurements differs in several aspects from de Haas-van Alphen other bandstructure models. The consequences the distortion of the Fermi Surface caused by the superlattice bandgap are analyzed. Using an inversion scheme the radius vectors of the closed noncentral electron sheets along the symmetry directions in the fourth BZ were determined. A value for the superlattice bandgap is calculated. Dissert. Abstr.

N81-24952 Illinois Univ. at Urbana-Champaign.
SILVER DIFFUSION AND ISOTOPE EFFECT IN SILVER RUBIDIUM IODIDE Ph.D. Thesis
James Simon Arzigian 1980 81 p
Avail: Univ. Microfilms Order No. 8108438

The diffusion coefficient of silver in silver rubidium iodide (RbAg4I5) was measured in both superionic phases using radiotracer Ag-110m and serial sectioning with a low temperature sectioning apparatus. The activation energies for diffusion in alpha-RbAg2I5 and beta-RbAg4I5. respectively, are .11 + or - .01 eV and .20 + or - .04 eV. These values are the same, within epxerimental error, as the observed activation energies for conduction. An isotope effect for diffusion has measured in both superionic phase; Ag-105 and Ag-110m radioisotopes were

used with gamma spectroscopy and energy discrimination. The effect is small, with no significant temperature variation, with the value at 333 K being .12 + or - .01. The second order phase transition at 208 K has a small effect, if any, on the magnitude of the effect. Dissert. Abstr.

N81-24953 Illinois Univ. at Urbana-Champaign.
THERMODYNAMIC PROPERTIES OF SOLID HELIUM USING AN ANHARMONIC ANISOTROPIC CONTINUUM MODEL Ph.D. Thesis
Terrell Dunlap Berker 1980 105 p
Avail: Univ. Microfilms Order No. 8108491

Using a 6-n potential with the de Boer value for the attractive parameter, the two repulsive parameters B(n) and n are varied to obtain a best fit to experimental hcp He-4 data. The n = 11 potential gives good volume dependence over the entire experimentally accessible volume range, but too large an isotope effect. The n = 10 potential gives a better mass dependence, but a less satisfactory volume dependence. Comparison of the calculations with experimental data shows that while it is possible to fit the volume dependence of the pressure, bulk modulus, and Debye temperature over a very wide range, the model overestimates the zero-point contribution to the free energy. The conclusion is that the major discrepancies obtained result from the failure of the continuum model to take account of dispersion. This failure can be remedied by artificially endowing the continuum with dispersion. A program for the further development of the model is outlined. Dissert. Abstr.

N81-24954 Illinois Univ. at Urbana-Champaign.
METHODS FOR LATTICE FIELD THEORY Ph.D. Thesis
Gary Allen Jongeward 1980 105 p
Avail: Univ. Microfilms Order No. 8108557

The lattice versions of the nonlinear sigma model in three dimensions and the Z2 gauge Higgs theory in three and four dimensions are studied. A brief introduction is given to lattice field theory and diseases the need for renormalization and the role of critical points in recovering the continuum properties of the system are described. The renormalization group is introduced and its application to the study of critical phenomena are discussed. A specific transformation developed by Migdal is applied to the nonlinear sigma model. The Monte Carlo method of Metropolis is applied to the Z2 gauge Higgs theory to determine its phase diagram. A very rich structure containing both first and second order phase transitions is found. Dissert. Abstr.

N81-24955 Illinois Univ. at Urbana-Champaign.
STUDY OF AN ELECTRONIC LOCALIZATION: DELOCALIZATION TRANSMISSION IN GERMANIUM-GOLD ALLOYS Ph.D. Thesis
Brian Wade Dodson 1980 74 p
Avail: Univ. Mcrofilms Order No. 8108491

This transition exhibits a continuous onset of zero temperature conductivity as x is increased, which is unconsistent with standard models of electronic localization in a random system. Models are presented for the conduction mechanisms near the metal insulator transition. At high temperatures the conductivity is dominated by inelastic electron phonon collisions providing a cutoff for a renormalization group treatment of quantum diffusion in a random potential. At low temperatures electron correlation effects modify the density of states strongly enough to dominate the conductivity. Dissert. Abstr.

N81-24956 Illinois Univ. at Urbana-Champaign.
RAMAN SCATTERING FROM THE SUPERCONDUCTOR NIOBIUM DISELENIDE Ph.D. Thesis
Ratnasingham Sooryakumar 1980 164 p
Avail: Univ. Microfilms Order No. 8108670

At 33 K, 2H-NbSe2 distorts into an incommensurate charge density wave (CDW) state. The Raman spectrum shows amplitude modes of A and E symmetry near 40 mc induced by the CDW. At 7 K this material becomes superconducting, and a 2 K we observe additional Raman peaks near 20 cm, one each of A and E symmetry. These are close in energy to the energy gap 2 delta, as measured by far infrared transmission. The Raman activity of the gap excitations is believed to be caused by coupling to the Raman active CDW phonon modes. Such coupling is shown directly by the changes in the Raman spectra at 2 K due to an applied magnetic field. The zero field results can be explained by a model in which the optical CDW phonon modes couple to superconducting electrons, and the resulting phonon self energy is calculated using the BCS theory for the electrons. Extensions of the zero field theory to include lifetime broadening effects and consequences of changing the electron-phonon coupling are presented. The results in an external magnetic field are explained in terms of a complex gap parameter. Dissert. Abstr.

N81-24957 Illinois Univ. at Urbana-Champaign.
SUPERCONDUCTIVITY AND THE STRUCTURAL PHASE TRANSITIONS IN PALLADIUM HYDRIDE AND PALLADIUM DEUTERIDE Ph.D. Thesis
Robert Wendell Standley 1980 130 p
Avail: Univ. Microfilms Order No. 8108674

The results of two experimental studies of the superconducting transition temperature of palladium hydride, PdH(x) and palladium deuteride, PdD(x) are presented. In the first study, the superconducting transition temperature of PdHx(Dx) is studied as a function of H(D) concentration, x, in the temperature range from 0.2 K to 4 K. In the second study, the effect of the order-disorder structural transition associated with the 50 K anomaly on the superconductivity of PdHx(Dx) is investigated. Samples were quenched to low temperatures in the disordered state, and their transition temperatures measured. The samples were then annealed just below the anomaly temperature, and the ordering process followed by monitoring the change in sample resistance. The transition temperatures in the ordered state were then measured. Dissert. Abstr.

N81-24958 Illinois Univ. at Urbana-Champaign.
ELECTRON TUNNELING INTO SUPERCONDUCTING INDIUM AND LEAD FILMS CONTAINING THE MAGNETIC IMPURITY MANGANESE Ph.D. Thesis
Juine-Kai Tsang 1980 143 p
Avail: Univ. Microfilms Order No. 8108690

Tunneling measurements were made of quench condensed In-Mn and Pb-Mn alloy films. The result were compared with Shiba's theory of superconductors containing magnetic impurities. The localized excited impurity states predicted by Shiba's theory were observed in both alloys in addition to s wave scattering it was necessary to include p and d wave scattering of the conduction electrons in the theory in order to explain the experimental data. Partial agreement between the theory and the experimental data was obtained using phase shift from band calculations. The results on In-Mn also agree with thermal conductivity data.
Dissert. Abstr.

N81-24959 Illinois Univ. at Urbana-Champaign.
PHOTOLUMINESCENCE AND DEPTH PROFILING STUDIES IN GALLIUM ARSENIDE PHOSPHIDE Ph.D. Thesis
Tan-Hua Yu 1980 119 p
Avail: Univ. Microfilms Order No. 8108712

An optical profiling technique combining low temperature photoluminescence and thin layer removal and secondary ion mass spectrometry are used to investigate the nitrogen activation and distribution in n-type VPE GaAs1-x)Px. The radiative recombination processes in the same material without N doping are also investigated by photoluminescence over a wide range of temperature. In GaAs and direct-gap N-free GaAs (l-x)Px bound exciton lines associated with donors and donor-to-valence-band transition dominate the low temperature spectra. Thermal quenching studies show that a process with an activation energy corresponding to the donor binding energy is responsible. In N-implanted GaAs (l-x) photoluminescence results show that high nitrogen activation and high quality crystal can be obtained after proper furnace annealing or electron beam annealing. Additional results are detailed. Dissert. Abstr.

N81-24960 Texas Univ. at Arlington.
THE DETECTION OF MICROWAVE PHOTONS FROM THE GROUND-STATE SPLITTING OF POSITRONIUM WITH A JOSEPHSON JUNCTION Ph.D. Thesis
Edward Overbeke Kluth 1980 82 p
Avail: Univ. Microfilms Order No. 8109195

Microwave photons at 203.7 GHz were detected from the ground-state splitting of positronium. Positrons emitted from the beta-decay of (22) Na were stopped in both liquid and gaseous

helium at 4.2 K to form positronium. The photons from the ground-state splitting were detected directly with a Josephson junction operated as a bolometer by correlating the junction output with the 1.3 MeV gamma ray emitted by (22) Na just before beta-decay. While good detection was obtained in helium gas, no photons were detected in helium liquid. The latter effect is attributed to attenuation by the large population of electrons trapped in cavities in the liquid. Dissert. Abstr.

N81-24961 Texas Univ. at Arlington.
LIQUID CRYSTAL PHASE TRANSITIONS: SELECTED TOPICS Ph.D. Thesis
Brian Joseph Mulvaney 1980 131 p
Avail: Univ. Microfilms Order No. 8109215

Several aspects of the nematic-smectic A and nematic-smectic C phase transitions in liquid crystals are theoretically The latent heat of the nematic-smectic C transition is found to depend on the tilt angle of the smectic layers. This connection between tilt angle and latent heat is used to explain the observed behavior of the latent heat as a function of concentration in a binary mixture of liquid crystals. Near the nematic-smectic transitions, the pretransitional increase of some of the fluid viscosities causes an increase in the spin-lattice relaxation time associated with director fluctuations. However, other noncritical mechanisms for spin-lattice relaxation prevent the relaxation time from becoming infinite at the transition. The attenuation and dispersion of sound waves also show anomalous behavior near the nematic-smectic a transition. A mode coupling theory is developed which explains the observed behavior. Coupling of the fluid density of the order parameter and the fluid velocity gives an isotropic contribution to the damping and dispersion.
Dissert. Abstr.

N81-24962 Stanford Univ., Calif.
SUPERCONDUCTIVITY AND TUNNELING SPECTROSCOPY OF AMORPHOUS TRANSITION METALS Mo AND Nb Ph.D. Thesis
Dan Benjamin Kimhi 1981 130 p
AVail: Univ. Microfilms Order No. 8108957

Thin amorphous films of Mo and Nb stabilized with nitrogen were prepared by e-beam deposition in an ultra high vacuum system. The film electrical characteristics were measured, as well as the tunneling characteristics of a junction between the film and a pre-deposited oxidized Al strip. The data were used to obtain the Eliashberg function Alpha(2)F(omega) by sever computer methods. The resulting spectra were found to be in excellent agreement with computer model calculations of the phonon spectrum of amorphous metals. However, these spectra differ from those of amorphous simple metals: The characteristic longitudinal and transverse phonon peaks degenerated to one wide peak, and there is no apparent enhancement of the low energy end of a2F(w) which results results in the weak coupling superconducting behavior commonly observed in amorphous transition metals. In addition, the results were compared to theoretical calculations of the electron-phonon interaction in transition metals. Dissert. Abstr.

N81-24963 Rensselaer Polytechnic Inst., Troy, N. Y.
THERMOMIGRATION OF NICKEL IN LEAD Ph.D. Thesis
Donald Guy Pierce 1980 110 p
Avail: Univ. Microfilms Order No. 8109321

The thermomigration of Ni in Pb(Ni) alloys was measured as a function of Ni concentration. The measurements were made by annealing the uniform alloys containing Ni-63 tracer in a temperature gradient of 200 C/cm to steady state with subsequent serial sectioning. Since Ni is a gast diffuser in Pb the times to reach steady state were as short as 7 hours. A radiation pyrometer mounted on a movable carriage was used to determine the temperature gradient and proved superior to the usual technique of placing thermocouples at intervals in the sample. Evidence gathered in the course of this investigation indicates that the solubility limit of Ni in Pb at 260 C is 1000 atomic ppm Ni, a factor of two less than the previously accepted value.
Dissert. Abstr.

N81-24964 State Univ. of New York at Stony Brook.
CRACK INTERACTION WITH DEFORMED MICROSTRUCTURES IN ZINC SINGLE CRYSTALS Ph.D. Thesis
Charles Messmer 1980 143 p
Avail: Univ. Microfilms Order No. 8109032

The energetics of crack propagation in zinc single crystals, as influenced by pre-deformed dislocation microstructures was investigated. The dislocation was varied by specifically oriented uniaxial strain tests which produced forest dislocations, and via torsional fatigue, which produced basal dislocations. These dislocation densities were quantitatively analyzed by Berg-Barret topography and chemical etch pit techniques. Precursor cracks were initiated using spark discharge apparatus. These precursor cracks were then expanded to interact with the induced substructures and functional relationships concerning the fracture toughness, surface energy, forest, and basal dislocation densities were obtained. Theoretical analysis and experimental results are detailed. Dissert. Abstr.

N81-24965*# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Chemical Engineering.
VAPOR PHASE DIAMOND GROWTH TECHNOLOGY Final Report
John C. Angus 30 Jan. 1981 17 p refs
(Contract NAS3-21965)
(NASA-CR-165285) Avail: NTIS HC A02/MF A01 CSCL 20L

Ion beam deposition chambers used for carbon film generation were designed and constructed. Features of the developed equipment include: (1) carbon ion energies down to approx. 50 eV; (2) in suit surface monitoring with HEED; (3) provision for flooding the surface with ultraviolet radiation; (4) infrared laser heating of substrate; (5) residual gas monitoring; (6) provision for several source gases, including diborane for doping studies; and (7) growth from either hydrocarbon source gases or from carbon/argon arc sources. Various analytical techniques for characterization of from carbon/argon arc sources. Various analytical techniques for characterization of the ion deposited carbon films used to establish the nature of the chemical bonding and crystallographic sturcutre of the films are discussed. These include: H2204/HN03 etch; resistance measurements; hardness tests; Fourier transform infrared spectroscopy; scanning auger microscopy; electron spectroscopy for chemical analysis; electron diffraction and energy dispersive X-ray analysis; electron energy loss spectroscopy; density measurements; secondary ion mass spectroscopy; high energy electron diffraction; and electron spin resonance. Results of the tests are summarized. J.M.S.

N81-24966# National Bureau of Standards, Washington, D.C. Electron Devices Div.
SEMICONDUCTOR TECHNOLOGY PROGRAM: PROGRESS BRIEFS Interim Report, Oct. - Dec. 1980
W. Murray Bullis Mar. 1981 12 p
(AD-A098029; NBSIR-81-2230) Avail: NTIS HC A02/MF A01 CSCL 20/12

The status of work on measurement technology for semiconductor materials, process control, and devices is reported. Emphasis is placed on silicon and silicon based devices. Highlighted activities include an analysis of the cross bridge sheet resistance test structure, observations of laser induced patterns on semiconductor surfaces, a technique for analysis of data from test sturctures on process validation wafers, and advances in optical measurements of line width on wafers. GRA

N81-24967# Hughes Research Labs., Malibu, Calif.
BASIC PROBLEMS IN InP TECHNOLOGY Final Report, 16 Nov. 1979 - 15 Nov. 1980
K. V. Vaidyanathan, H. L. Dunlap, R. A. Jullens, and C. L. Anderson Mar. 1981 53 p refs
(Contract F49620-80-C-0038; AF Proj. 2306)
(AD-A098113; AFOSR-81-0405TR) Avail: NTIS HC A04/MF A01 CSCL 20/12

The growth and characteristics of high purity epitaxial InP layers grown by liquid phase epitaxy are described. Silicon and sulfur will be the dominant residual donors in LPE grown InP. Techniques to reduce the residual donor concentration in the LPE layers are discussed. Chemical polishing the mesa etching of InP and ohmic contact studies to n and p type InP are discussed. Preliminary investigations show that at power densities of 50,000 W per sq cm, permanent laser induced surface damage occurs in InP. Thus laser annealed ohmic contacts need to be

formed at power densities 50,000 W per sq cm. Severe surface degradation was observed in SiO2 encapsulated, ion implanted InP samples annealed at 700 C. The use of phosphorus doped glass (PSG) dramatically reduces such surface degradation. The electrical properties of Be and Si implanted layers are reported as functions of both implantation dose and anneal temperature. Preliminary secondary ion mass spectrometry (SIMS) studies show that at high concentrations dramatic redistribution effects occur in Be implanted and annealed InP, while no significant diffusion occurs in Si implanted and annealed InP. GRA

N81-24968# Hughes Research Labs., Malibu, Calif.
LIQUID CRYSTAL MATERIALS FOR MATRIX DISPLAYS Final Technical Report, 1 Jun. 1979 - 30 Dec. 1980
J. David Margerum and Anna M. Lackner Apr. 1981 69 p refs
(Contract N00014-79-C-0524)
(AD-A098307; TR-1) Avail: NTIS HC A04/MF A01 CSCL 14/2

Studies are made on improved liquid crystal (LC) materials for use in MOSFET matrix displays operated with dc-activated dynamic-scattering (DS). The results provide a basis for development of nematic LC materials capable of wide-temperature-range storage, dc operation at elevated temperatures (35 to 71 C), and long lifetime displays. LC structural effects are evaluated by using different combinations of components from eight classes of esters, including phenyl benzoates, phenyl thiobenzoates, phenyl cyclohexanecarboxylates, phenyl acyloxybenzoates, a phenyl benzoyloxybenzoate, and a phenyl biphenylcarboxylate structure. Six mixtures are characterized at 25 C, and their viscosity, dielectric anisotropy, conductivity anisotropy, and dc-activated DS effects are studied at elevated temperature. Three mixtures are thermally stable at 100 C in evacuated tubes, with redox dopants present. Their dc-DS stability is studied at 55 C, both in transparent cells and in cells with reflective metal electrodes. Correlations from these studies provide a good basis for further optimization of LCs for matrix displays. However, additional studies are needed on thermal instability problems caused by reactions with glass surfaces and with organic sealants in display cells at elevated temperatures. Author (GRA)

N81-24969# Kansas State Univ., Manhattan. Dept. of Physics.
PULSED RAMAN MEASUREMENT OF THE ONSET OF RECRYSTALLIZATION IN LASER ANNEALING
H. W. Lo and A. Compaan Feb. 1981 10 p refs
(Contract N00014-80-C-0419)
(AD-A098192) Avail: NTIS HC A02/MF A01 CSCL 20/2

We have made the first time-resolved measurement of the onset of recrystallization following pulsed laser irradiation of ion-implanted silicon. We find recrystallization to be nearly complete 25 nsec after a 7 nsec annealing pulse with focussed energy density of 0.6 J/sq cm. GRA

N81-24970# Kansas State Univ., Manhattan. Dept. of Physics.
PULSED RAMAN TEMPERATURE MEASUREMENTS OF LASER HEATED SILICON
A. Compaan and H. W. Lo 1980 6 p refs Presented at the 11th Intern. Conf. on Defects and Radiation Effects in Semicond., Oiso, Japan, 8-11 Sep. 1980 Submitted for publication
(Contract N00014-80-C-0419)
(AD-A098193) Avail: NTIS HC A02/MF A01 CSCL 20/2

Time resolved Raman light scattering determinations of temperature have been made in crystalline silicon where it is found that the lattice temperature is far below melting even for laser power densities of approx. 1 J/sq cm at 485 nm. In ion-implantation-amorphized silicon the pulsed laser Raman technique has identified substantial recrystallization as early as 30 nsec after the peak of the heating pulse. Author (GRA)

N81-24971# North Carolina State Univ., Raleigh. Engineering Research Services Div.
SINGLE CRYSTAL EPITAXY AND CHARACTERIZATION OF BETA SILICON CARBIDE Annual Report, 1 Jan. - 31 Dec. 1980
Robert F. Davis 31 Mar. 1981 36 p
(Contract N00014-79-C-0121; RR0210203; NR Proj. 234-027)
(AD-A098234; ONR-243-027-009) Avail: NTIS HC A03/MF A01 CSCL 20/2

Single crystal thin films of beta-SiC of up to five microns in thickness have been epitaxially grown on (111) Si by very carefully controlled chemical vapor deposition techniques wherein the pressure and flow rates of the reactive gases are independent of one another. Theoretical CVD phase equilibrium diagrams for the Si-C system have been calculated for various reactive and carrier gases, temperatures and pressures. A special sputtering unit has also been remodeled in order to produce amorphous SiC which can be annealed to form beta-SiC or which may be used for substraes for subsequent CVD growth of this material. GRA

N81-24972# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerperforschung.
DETERMINING THE SOLUBILITY AND DIFFUSIVITY OF HYDROGEN AND DEUTERIUM IN THE IRON-TITANIUM MIXED CRYSTAL PHASE BY RESISTANCE MEASUREMENTS
G. Arnold Feb. 1980 95 p refs In GERMAN; ENGLISH abstract
(JUEL-1648) Avail: NTIS (US Sales Only)HC A05/MF A01; DOE Depository Libraries

The solubility of hydrogen and deuterium in FeO5TiO5 is studied. Macroscopic samples are charged from the gas phase without permeation barriers. The absolute concentration and its time dependence is determijned from measurements of the electrical resistivity. The specific change in resistivity per unit concentration is 820 (MU) (LAMBDA)cm for both H2 and D2. The solution for both gases is endothermic; the solubility limit is given by 1g X sub alpha = 1.1 - 1340/T. The partiial molar quantities are calculated for infinite dilution. For hydrogen (and deuterium) thE enthalpy of solution is -39.0 J/K mol sub H (-41.7 J/K mol sub D). From absorption and desorption measurements values for the diffusion constant are determined. The activation model which is based on the segregation of iron clusters at the surface is indirectly verified. DOE

N81-24973# Ames Lab., Iowa.
LATTICE DYNAMICS IN THE ALPHA PHASE OF THE IVB TRANSITION ELEMENTS Ph.D. Thesis
David Kevin Arch 1980 215 p refs
(Contract W-7405-eng-82)
(IS-T-921) Avail: NTIS HC A10/MF A01

Inelastic neutron scattering techniques were used to study the temperature dependent lattice dynamics of the group IVB transition elements, titanium and hafnium, in the hexagonal close packed phase. The dispersion curves as well as their temperature dependence were investigated in order to obtain information about the temperature dependence of the thermophysical properties of these elements as well as the change with temperature of the electronic response to the nuclear motions. The data for hcp Ti and hcp Hf were used to evaluate the lattice specific heat at constant pressure as a functfon of temperature. The calculated total specific heat, obtained by taking into account the electronic contribution, was found to agree rather well with direct specific heat measurements. DOE

N81-24974# Rockwell International Science Center, Thousand Oaks, Calif.
LIQUID-PHASE-SINTERING PHENOMENA OF NON-OXIDE SILICON COMPOUNDS Technical Progress Report, 1 Jul. 1979 - 29 Feb. 1980
D. R. Clarke and F. F. Lange Mar. 1980 50 p refs
(Contracts DE-AC03-78ER-01885; ER-78-C-03-1885)
(DOE/ER-01885/T1) Avail: NTIS HC A03/MF A01

The noncrystalline intergranular phase in three hot pressed silicon nitride alloys containing MgO was found to have a composition close to the SiO2-Mg2SiO3 tie line. This finding of a composition removed from the ternary eutectic in the Si3N4Si2N2O-Mg2SiO4 phase field suggests that phase equilibrium during hot pressing is not totally attained despite the X-ray diffraction evidence that the bulk of the materials has reached equilibrium. The exact composition of the noncrystalline phase varies from one location to another in the microstructure

and incorporates impurities including Ca, Al, and Cl. These impurities will unquestionably affect the high temperature properties of the intergranular phase. DOE

N81-24975# Spire Corp., Bedford, Mass.
A NOVEL TECHNIQUE FOR FABRICATING OPTOELECTRONIC MATERIALS Final Report, 1 Oct. 1979 - 31 Mar. 1980
A. C. Greenwald 1 Apr. 1980 50 p refs
(Grant NSF DAR-79-17704)
(PB81-148942; FR-60022; NSF/RA-800310) Avail: NTIS HC A03/MF A01

The application of high current ion implantation and pulsed electron beam annealing to fabricate optoelectronic materials for heterostructural, injection electroluminescent devices and detectors is discussed. Gallium arsenide substrates were implanted at room temperature with P and Ga to form GaAs1-xPx, or were implanted with Al and As to form Ga1-xAlxAs. A large area pulsed electron beam was used to melt only the radiation damaged implanted surface layer which underwent epitaxial regrowth upon cooling. Reflected electron diffraction confirmed the epitaxial single crystal structure of the surface. Auger spectroscopy with ion sputtering showed that the maximum value of x achieved for either compound was 0.1, a limit imposed by ion sputtering during implantation. GRA

N81-24976# Crystal Systems, Inc., Salem, Mass.
GROWTH OF RUBY CRYSTALS BY THE HEAT EXCHANGER METHOD, PHASE 1: NSF SMALL BUSINESS INNOVATION RESEARCH Final Report, 1 Oct. 1979 - 31 Mar. 1980
Frederick Schmid and Chandra P. Khattak 31 Mar. 1980 38 p refs
(Grant NSF DAR-79-17180)
(PB81-150302; NSF/RA-800308) Avail: NTIS HC A03/MF A01 CSCL 20B

Conditions for the growth of large, uniformly doped laser crystals by the heat exchanger method are explored. Determination of the melt point, selection of crucible material and establishment of furnace operating parameters are discussed. The melt point of ruby was found to be 2040 plus or minus 10 C. Molybdenum crucibles can be used to contain ruby in vacuum as well as under argon atmospheres at desired superheat temperatures over extended periods required for crystal growth. Thermodynamic analysis was conducted and vapor pressures of volatile species calculated. Experimentally, volatilization of chromium oxides was suppressed by using welded covers on crucibles and operating under an argon pressure in the furnace. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N81-24977 New Hampshire Univ., Durham.
TOPICS IN QUANTUM FIELD THEORY Ph.D. Thesis
Charles Henry Tabb 1980 102 p
Avail: Univ. Microfilms Order No. 8108875

A gauge invariant action functional for non-abelian gauge theories is derived from the vacuum to vacuum transition amplitude. This effective action is then examined in the loop expansion, where it is demonstrated that the unrenormalized one-loop term is equal to the change in the zero point energy of the theory due to the presence of a non-vanishing background field. The one loop term is carefully evaluated in Euclidean space, and the positivity of the one loop eigenvalues is related to classical stability in terms of energy minimality. The case of negative eigenvalues is considered and a procedure for regularizing the one loop term for this problem is defined. An imaginary part of the effective action to this order is shown to indicate an instability of the theory in the presence of a nonvanishing background field. Finally, complications due to the occurrence of gyroscopic terms are reviewed. Dissert. Abstr.

N81-24978# Tennessee Univ., Knoxville. Ultrasonics Lab.
A DETAILED STUDY OF ULTRASONIC NONLINEARITY IN RELATION TO OTHER THERMODYNAMIC PROPERTIES OF SOLIDS: RESULTS FOR SILICON AND GERMANIUM BETWEEN 3 AND 300 K Interim Report
Jacob Philip Mar. 1981 171 p refs
(Contract N00014-76-C-0177; NR Proj. 384-306)
(AD-A097724; TR-19) Avail: NTIS HC A08/MF A01 CSCL 20/11

It is shown that measurement of the ultrasonic nonlinearity parameters of solids throws light on their thermodynamic properties. Establishment of the relation between ultrasonic nonlinearity and thermal properties has been achieved for the diamond-like solids by determining the third-order elastic (TOE) constants and their variation with temperature. Study has been done on silicon and germanium. The nonlinear equation for the propagation of acoustic waves is derived and solved for longitudinal wave propagation along the pure mode directions of a cubic crystal. Because of the nonlinearity of the medium, an initially sinusoidal 30 MHz wave undergoes waveform distortion and harmonics are generated. The ultrasonic nonlinearity parameters of the medium can conveniently be determined by measuring the amplitudes of the fundamental and generated second harmonic. Such measurements are done as a function of temperature between liquid helium and room temperature using capacitive receiver. The measurements lead to the K3 parameters which are combinations of TOE constants. Temperature variation of these parameters are studied. Combining our results with an established lattice dynamical model for diamond-like solids (the Keating model) has enabled us to determine the anharmonic force constants involved in the model as a function of temperature, and subsequently to determine all the six TOE constants. The temperature variations of all the TOE constants of silicon and germanium are plotted between 3 and 300 K. GRA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N81-24979 Illinois Univ. at Urbana-Champaign.
STRATIGIES IN MULTIPLE CRITERIA DECISION MAKING Ph.D. Thesis
Manoochehr Ghiassi 1980 141 p
Avail: Univ. Microfilms Order No. 8108515

The Multiple Criteria Decision Making (MCDM) problem is considered in its general form. The focus is on multiple objective linear programming (MOLP) problems. The MCDM is examined for possible modifications in an attempt to resolve conflicts among the objectives. The concept of the range of compromise is introduced. Determination of the range of compromise requires evaluation of two parameters n sub v the minimum value that objective v can take within the nondominated set and M sub v the maximum feasible value for objective v. An algorithm is developed to find n sub v. Evaluation of M Sub v is a straightforward linear programming problem. A weighting method called Dimensionless Weighting Method is employed to solve the MOLP problem. Two different kinds of composite functions are introduced: (1) the linearly weighted composite function; and, (2) the Minimax formulation. Dissert. Abstr.

N81-24980 Case Western Reserve Univ., Cleveland, Ohio.
A DYNAMIC RESOURCE ALLOCATION METHODOLOGY FOR LARGE TECHNOLOGY-BASED ORGANIZATIONS Ph.D. Thesis
Virendra Sharad Sherlekar 1981 404 p
Avail: Univ. Microfilms Order No. 8109609

A generalized framework for research and development (R&D) management, the Dynamic Resource Allocation Methodology (DRAM) for use in large technology based organizations is presented. The research effort provides an assessment of major issuesin R&D allocation and the Zero-Base Budgeting (ZBB), and a test of applicability of DRAM to solar energy research, development and demonstration (RD&D) programs. DRAM utilizes: (1) Strategic Program Activity Networks (SPAN) to identify interdependencies, multi-period costs of development, and alternative funding levels analysis required by ZBB; (2) Goal Programming (GP) and Dynamic Programming (DP) approaches to determine funding levels for subsystems, and to select technical approaches such that the organization can determine optimum risk level and subsystem goals; (3) Eigenvalue prioritization to determine relative importance of multiple criteria, and a scoring model to determine priorities of technology options; and (4) GP and DP approaches to allocate resources to technology options in the ZBB process. Dissert. Abstr.

N81-24981# Meyer (A. F.) and Associates, Inc., McLean, Va.
SAFETY ANALYSIS AND REVIEW SYSTEM, PHASE 1 Final Report
Ellen T. Browne Mar. 1981 8 p refs
(Contract DE-AM01-80ET-13650)
(DOE/ET-13650/9) Avail: NTIS HC A02/MF A01

Work completed in support of the implementation of the DOE Safety Analysis and Review System (SARS) is summarized. The following were among the issues identified as requiring further overview, assessment, and action by DOE: (1) there needs to be firm guidance from DOE Headquarters (HQ) in regard to SARS-related responsibilities and requirements of the DOE field offices; (2) a system must be established to track the applicability and progress of SARS for individual DOE operations; (3) a decision must be made by DOE officials as to whether review authority for moderate risk projects will be delegated to the field. As part of this, a detailed assessment of resources available for reviews, both at the field and HQ levels, needs to be accomplished; and (4) to be implemented effectively, SARS needs to be incorporated into the overall DOE project management system. DOE

N81-24982# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
PROCESS MODELS: ANALYTICAL TOOLS FOR MANAGING INDUSTRIAL ENERGY SYSTEMS
Stephen O. Howe, David A. Pilati, Chip Balzer, and F. T. Sparrow (Purdue Univ., Lafayette, Ind.) 1980 20 p refs Presented at the 7th Natl. Conf. on Energy and the Environment, Phoenix, Ariz., 30 Nov. - 3 Dec. 1980
(Contract DE-AC02-76CH-00016)
(BNL-28837; CONF-801171-3) Avail: NTIS HC A02/MF A01

How the process models are used to analyze industrial energy systems is described and illustrated. Following a brief overview of the industry modeling program, the general methodology of process modeling is discussed. The discussion highlights the important concepts, contents, inputs, and outputs of a typical process model. A model of the US pulp and paper industry is discussed as a specific application of process modeling methodology. Applications addressed include projections of energy demand, conservation technology assessment, energy-related tax policies, and sensitivity analysis. A subsequent discussion of these results supports the conclusion that industry process models are versatile and powerful tools for managing industrial energy systems. DOE

N81-24983 International Institute for Applied Systems Analysis, Laxenburg (Austria).
WHO LEARNS WHAT? A CONCEPTUAL DESCRIPTION OF CAPABILITY AND LEARNING IN TECHNOLOGICAL SYSTEMS
Mark F. Cantley and Devendra Sahal Dec. 1980 40 p refs
(IIASA-RR-80-42) Avail: NTIS HC A03

Technological innovation and a general theory of developmental processes are considered, taking Bonner's description of biological development as an analogy. The pursuit of economies in scale (size and productive efficiency) exemplifies the parallelism with biological development. The evolution of technological capability is seen as a learning process in which information is acquired, stored, and transmitted. Efficient means of information or technology transfer (human capabilities) differentiate learning in technological fields from biological evolution by natural selection. The phenomenon known as cumulative experience, manifest in the learning curve is introduced. Learning is modeled as a multilevel process, and levels which distinguish the type of learning or information transfer characteristic of each level are described, answering the question 'who learns what'.
Author (ESA)

N81-24984# Public Technology, Inc., Washington, D. C.
EVALUATION OF WESTERN EUROPEAN TECHNOLOGIES IN THE FIELDS OF ENERGY AND MANAGEMENT IMPROVEMENT Final Report
May 1980 81 p
(Grant NSF ISP-77-15089)
(PB81-135170; NSF/RA-800268) Avail: NTIS HC A05/MF A01 CSCL 05A

The following technologies were examined in England: public lighting, nomograms; police management training simulation software; a highway maintenance data system; fuel conservation; energy sources; traffic controls and management; low energy housing; the PRESTEL television data system; performance review methods; and a waste separation plant. Technologies observed in France included geothermal district heating; cogeneration of electricity and heating; and microprocessors for vehicle tune up and peak load control. Some systems observed in Germany included a thermobile, used to make retrofit decisions for buildings to meet Federal heat loss standards; a Federal energy policy; review; new building standards; a modernization program; geoprocessing; a color printer; energy and traffic analyses; digitizing technology; and solid waste conversion. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N81-24985 Illinois Univ. at Urbana-Champaign.
BROWSING IN DATA BASES Ph.D. Thesis
Douglas Duane Dankel, II 1980 201 p
Avail: Univ. Microfilms Order No. 8108477

One possible organization for a browsing system containing models and heuristics is suggested. The models describe the organization of the data base and the objects from which the data was gathered. The heuristics provide knowledge on important features which might exist within the data base and techniques for locating these features. An implementation of the organization was performed using a data base describing maintenance performed on Navy aircraft. This computer system, BROWSER, attempts to find recurring time sequences of maintenance performed on different groups of aircraft. The user is then notified of these discoveries in the hope that changes will be made to improve the performance of the aircraft.
Dissert. Abstr.

N81-24986* National Aeronautics and Space Administration, Washington, D. C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY: A CONTINUING BIBLIOGRAPHY. SECTION 1: ABSTRACTS, SUPPLEMENT 17
Jul. 1980 59 p
(NASA-SP-7039(17)) Avail: NTIS HC $8.50 CSCL 05B

Abstracts are cited for 150 patents and applications for patents introduced into the NASA scientific and technical information system during the period January 1980 through June 1980. Each entry consists of a citation, an abstract, and in

most cases, a key illustration selected from the patent or application for patent. A.R.H.

N81-24987# Science Applications, Inc., Englewood, Colo.
BETC INFORMATION MANAGEMENT SYSTEM WITH FOCUS ON ROS ESTIMATION Final Report
J. K. Willoughby, J. A. Gardner, S. B. Heath, and M. A. Kehler Nov. 1980 106 p refs
(Contract DE-AC19-79BC-10032)
(DOE/BC-10032/24) Avail: NTIS HC A06/MF A01

A special purpose information data base system was signed for the Bartlesville Energy Technology Center (BETC) to support the technical staff in the areas of Enhanced Oil Recovery (EOR) and Residual Oil Saturation Estimation (ROS). The analysis of usage patterns revealed that four basic data types were required most often by potential system users. These were: (1) numeric files; (2) bibliographic citations and abstracts; (3) project information such as schedules and budgets; and (4) references to persons that were authorities in various relevant topical areas. The need for a unique subject taxonomy and for four different data types resulted in the design of a system that permits the retrieval of information by searching the subject taxonomy, selecting a usbject term, or terms, and determining the appropriate data types in one step searching. DOE

N81-24988# Department of Energy, Oak Ridge, Tenn. Technical Information Center.
STANDARD DISTRIBUTION FOR UNCLASSIFIED SCIENTIFIC AND TECHNICAL REPORTS: INSTRUCTIONS AND CATEGORY SCOPE NOTES
Dec. 1980 27 p
(DOE/TIC-4500-Rev-69) Avail: NTIS HC A03/MF A01

The US Department of Energy Technical Information Center (DOE/TIC) uses a subject category scheme for classifying and distributing DOE originated or sponsored unclassified scientific and technical reports. The subject category scope notes used for these purposes are included. Originators of DOE or DOE sponsored scientific and technical reports are urged to adhere to the instructions contained in this publication. DOE

N81-24989# National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
GUIDELINES FOR IMPLEMENTING DATA RESOURCE MANAGEMENT
Dec. 1980 109 p
(PB81-153538) Avail: NTIS HC A06/MF A01 CSCL 05B

Data Resource Management concerns knowledge and management of data and of its composition, sources, dissemination, flow, locations, and uses. It is a management program which applies to the management of data the basic principles of resource management. One of the three final reports of Federal information Processing Standards Task Group 17 is included which provides guidelines on the characteristics, tools, and implementation of a Data Resources Management program. GRA

N81-24990# Office of Management and Budget, Washington, D. C.
FEDERAL INFORMATION COLLECTION: AGENCY ACTIONS ON COMMISSION ON FEDERAL PAPERWORK RECOMMENDATIONS. VOLUME 1: MULTI-AGENCY RECOMMENDATIONS
Dec. 1980 71 p
(PB81-158941) Avail: NTIS HC A04/MF A01 CSCL 05B

Congress created the Commission on Federal Paperwork to study the Federal Government's burgeoning information gathering activities and to recommend changes in the Government policies and practices that impact on the paperwork burden. The legislation that established the Commission also required monitoring and reporting on executive branch agency responses to the Commission's recommendations. This publication and others in this series are in response to that requirement. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N81-24991# Committee on Commerce, Science, and Transportation (U. S. Senate).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ACT, 1982
Washington GPO 1981 58 p Rept. to accompany S. 1098 presented by the Comm. on Com., Sci., and Transportation at the 97th Congr., 1st Sess., 15 May 1981
(S-Rept-97-100; GPO-79-010) Avail: US Capitol, Senate Document Room

Appropriations proposed by the Senate Committee after consideration of NASA's request of 6,725,700,000 in funding for fiscal year 1982 and the President's suggested reduction of $603,500,000 in that agency's budget are presented. The revised budget authorizes expenditures of $5,000,000,000 for research and development, $104,400,000 for the construction of facilities, and $1,118,100,000 for research and program development. A.R.H.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N81-24992*# National Aeronautics and Space Administration, Washington, D. C.
EFFECTS OF STREET TRAFFIC NOISE IN THE NIGHT
Brigit Wehrli, J. Nemecek, V. Turrian, R. Hoffman, and H. Wanner Mar. 1980 31 p refs Transl. into ENGLISH from Kampf der Laerm, v. 25, 1978 p 138-149 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Inst. for Hygiene and Work Physiology of ETH
(Contract NASw-3199)
(NASA-TM-75495) Avail: NTIS HC A03/MF A01 CSCL 13B

The relationship between automobile traffic noise and the degree of disturbance experience experienced at night was explored through a random sample survey of 1600 individuals in rural and urban areas. The data obtained were used to establish threshold values. A.R.H.

N81-24993# Committee on Science and Technology (U. S. House).
UNITED STATES CIVILIAN SPACE POLICY
Darrell R. Branscome Washington GPO 1981 48 p Presented by the Subcomm. on Space Sci. and Appl. of the Comm. on Sci. and Technol., 97th Congr., 1st Sess., Apr. 1981
(GPO-70-213) Avail: Subcommittee on Space Science and Applications CSCL 05A

In order to augment public support for space goals, the Administration is asked to make a financial commitment to space engineering initiatives including: (1) a manned space operating

base in low Earth orbit; (2) a Mars sample return mission; (3) a Global Resource Information System. S.F.

N81-24994*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SYSTEM SAFETY IN STIRLING ENGINE DEVELOPMENT
H. Bankaitis 1981 29 p refs Presented at the 5th. Intern. Systems Safety Conf., Denver, 26-31 Jul. 1981
(Contract DE-AI01-77CS-51040)
(NASA-TM-82615; DOE/NASA/51040-25; E-867) Avail: NTIS HC A03/MF A01 CSCL 10B

The DOE/NASA Stirling Engine Project Office has required that contractors make safety considerations an integral part of all phases of the Stirling engine development program. As an integral part of each engine design subtask, analyses are evolved to determine possible modes of failure. The accepted system safety analysis techniques (Fault Tree, FMEA, Hazards Analysis, etc.) are applied in various degrees of extent at the system, subsystem and component levels. The primary objectives are to identify critical failure areas, to enable removal of susceptibility to such failures or their effects from the system and to minimize risk. T.M.

N81-24995# California Univ., Berkeley. Lawrence Berkeley Lab. Earth Sciences Div.
THERMAL AND THERMOMECHANICAL DATA FROM IN SITU HEATER EXPERIMENTS AT STRIPA, SWEDEN
Tin Chan, Eugene Binnal, Philip Nelson, Robert Stolzman, Oliver Wan, Christopher Weaver, Kim Ang, James Braley, and Maurice McEvoy Sep. 1980 242 p refs
(Contract W-7405-eng-48)
(LBL-11477; TIF-29) Avail: NTIS HC A11/MF A01

Heater experiments, conducted in a granite body adjacent to a recently abandoned iron ore mine at Stipa, Sweden, to investigate the response of a hard rock mass to thermal loading, lasted for approximately one year. The rock was heavily instrumented to measure the temperature, displacement, and stress fields. Monitoring of the rock response continued for half a year after the heaters were deactivated. The enormous data base (approximately 50 million measurements), recorded by a computer-based data acquisition system, was structured, verified, and converted to engineering units. The types of data available and the procedures used for data acquisition, and transfer, encoding-decoding, reorganization, storage, processing, and verification are described. Information is given on data structure and format and how potential users can access the computer-readable data. DOE

N81-24996# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
FURTHER EXPERIMENTS ON THE CLEANING OF SEWER PIPES WITH THE HELP OF SPHERES
A. Dinkelacker Feb. 1980 79 p refs In GERMAN; ENGLISH summary
(MPIS-2/1980; ISSN-0436-1199) Avail: NTIS HC A05/MF A01

The spheres are moved through the pipes by the flow of the sewage. The experiments were performed with spheres of 0.56 m diameter in sewer pipes of 1.40 m diameter. Normal flow and mud conditions existed in the pipes during the experiments. Results show that a remarkable cleaning effect is achieved due to the action of the spheres. After two days of application of spheres the thickness of the sedimented mud layer decreased from 12 cm to 7 cm. This decrease corresponds to a removal of 60 kg of mud per meter of pipe length.
Author (ESA)

N81-24997# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Informatique.
ON THE MOBILITY OF PEOPLE LIVING IN THE PARISIAN SUBURBS [MOBILITE DES HABITANTS DE LA BANLIEUE PARISIENNE]
Yves LeFoll and Jean-Marie Molina Oct. 1980 17 p refs In FRENCH Presented at Methodes Mathematiques Appl. a la Geograph., Besancon, 2-3 Oct. 1980
(ENST-C-80004) Avail: NTIS HC A02/MF A01

The problem of modeling the mobility of people, considering their overall needs for urban transportation in function of their activities and of their socio-economic environment, is approached statistically. Travel behavior is described for a sample of 1600 people polled by questionnaire. The coding and multidimensional analysis techniques employed are explained and shown well-adapted to the complexity of the phenomena studied. Six factors which differentiate the travel behavior of people are indentified. The sample group is then classified into nine subgroups of mobility which are subsequently typified and hierarchically arranged. A time-space structured estimation of demand on public transportation can thus be obtained. Author (ESA)

N81-24998# Battelle Southern Operations, Atlanta, Ga.
REPLICATION AND EVALUATION OF SELECTED INNOVATIONS DEVELOPED WITHIN THE URBAN TECHNOLOGY SYSTEM. REPORT 1: PROJECT HISTORY, EVALUATION AND RECOMMENDATIONS Final Report
J. Mercer 1980 41 p
(Grant NSF ISP-77-13029)
(PB81-134736; NSF/RA-800260; Rept-1) Avail: NTIS HC A03/MF A01; Also available in set of 3 reports HC E08 as PB81-134728-SET CSCL 05A

The results of a research project on the replication of innovations developed within the urban technology system are presented. The system is a nationwide technology transfer network which was initiated to test factors associated with the stimulation of innovation in local government operations. A historical description of the project structure is given and observations and lessons learned about the replication process are discussed. The barriers and facilitators related to the replication of innovations are also described. Various aspects of projects utilization, project evaluation, and recommendations for future research reported. R.C.T.

N81-24999# Battelle Southern Operations, Atlanta, Ga.
REPLICATION AND EVALUATION OF SELECTED INNOVATIONS DEVELOPED WITHIN THE URBAN TECHNOLOGY SYSTEM. REPORT 2: CASE STUDIES Final Report
J. Mercer 1980 32 p 3 Vol.
(Grant NSF ISP-77-13029)
(PB81-134744; NSF/RA-800261; Rept-2) Avail: NTIS HC A03/MF A01; Also avaiable in set of 3 reports HC E08 as PB81-134728-SET CSCL 05A

Case studies are presented which illustrate the transfer of three innovations to six local government jurisdictions. The following combinations are evaluated: project control system to Lincoln, Nebraska and East Point, Georgia; solar hot water heating to Middletown, Ohio and Austin, Texas; and telephone cost control to Denton, Texas and Chesterfield County, Virginia. GRA

N81-25000# Battelle Southern Operations, Atlanta, Ga.
REPLICATION AND EVALUATION OF SELECTED INNOVATIONS DEVELOPED WITHIN THE URBAN TECHNOLOGY SYSTEM. REPORT 3: TECHNOLOGY REPLICATION PACKAGES Final Report
J. Mercer Mar. 1980 84 p
(Grant NSF ISP-77-13029)
(PB81-134751; NSF/RA-800262; Rept-3) Avail: NTIS HC A05/MF A01; Also available in set of 3 reports HC E08 as PB81-134728-SET CSCL 05A

Three replication projects developed by the urban technology system are reported: telephone cost control innovations for implementation; solar hot water heating; and project control systems. Overall objectives of these projects are the evaluation and replication of selected innovations in local government service delivery and a determination of critical factors which enhance or impede the replication process. The solar heating package is structured to provide guidelines for implementing solar hot water heating in public housing. The project control system replication package discusses schedules reports, and monitoring system involved project control and suggested procedure for implementing a project control system. GRA

N81-25001# Boeing Co., Seattle, Wash. Automated Transportation Systems.
MORGANTOWN PEOPLE MOVER ELECTROMAGNETIC COMPATIBILITY PROGRAM Final Report
T. H. Herring Sep. 1980 107 p
(Contract MA-06-0048)

(PB81-148082; DOT-TSC-UMTA-80-35; UMTA-MA-06-0048-80-10) Avail: NTIS HC A06/MF A01 CSCL 13F

Electromagnetic Compatibility (EMC) of a transit system is the absence of interference between all parts of the system, and between the system and the community which it serves. The EMC experience obtained during the design and development of the Morgantown People Mover (MPM) system in Morgantown, West Virginia addresses background regarding the development of the MPM system and its current configuration as well as discussions pertaining to EMC. Conceptual and practical EMC requirement considerations and descriptions of the resulting requirements are presented. The analysis and testing performed to verify EMC is outlined and EMC problems unique to MPM are detailed. GRA

N81-25002# Boeing Co., Seattle, Wash. Automated Transportation Systems.

MORGANTOWN PEOPLE MOVER REDUNDANT COMPUTING SYSTEM DESIGN SUMMARY Final Report

Jim I. Rucker and Bert J. Hill Sep. 1980 159 p

(Contract MA-06-0048)

(PB81-151367; DOT-TSC-UMTA-80-36; UMTA-MA-06-0048-80-8; DTS-723) Avail: NTIS HC A08/MF A01 CSCL 13F

The redundant computing system design used for the current 1980 Phase 1 Morgantown People Mover (MPM) system is described. The redundant computing system is that part of the control and communications system (C&CS) consisting of redundant computer hardware and software and the special purpose equipment (SPE) used to interface the dual computing system to the rest of the C&CS system. The Morgantown project, which began in 1969, is an Urban Mass Transportation Administration program that provides a personal rapid transit system between the central business district of Morgantown, West Virginia, and the widely separated campuses of West Virginia University. The MPM system is an automated, two mode (schedule and demand) transit system that consists of a fleet of electrically powered, rubber tired, passenger carrying vehicles operating on a dedicated guideway network under the redundant computing system computer control. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N81-25003 Texas Univ. at Arlington.

MULTIPLE MODELS IN DELTA SCUTI STARS Ph.D. Thesis

Gregory Lee Loumos 1980 300 p

Avail: Univ. Microfilms Order No. 8109198

A group of seven low amplitude pulsationally complex Delta Scuti stars were extensively observed photometrically to millimagnitude accuracy during five years. These data were analyzed for frequency structure using both the existing tools and modifications to these tools. For each star the primary light variation is due to stable pulsation in a number of frequencies, this number ranging from two to perhaps nine. The derived frequencies imply that some of the group are purely nonradial. Also, there appears to be a small residual variation that cannot be ascribed to either observational noise or a few stable frequencies, these residuals being greater for the more complex members of the group. It is suggested that the division between simple and complex multiple mode Delta Scuti stars occurs at a diagonal line in the color magnitude diagram, the more complex pulsators being cooler and less luminous. Dissert. Abstr.

N81-25004 Washington Univ., Seattle.

PHOTOMETRIC ABUNDANCES OF CEPHEID VARIABLES IN THE GALAXY AND THE SMALL MAGELLANIC CLOUD Ph.D. Thesis

Hugh Courtney Harris 1980 185 p

Avail: Univ. Microfilms Order No. 8109735

Washington system colors and V magnitudes are described for classical and Type 2 cepheids. The sample includes 102 classical cepheids and 63 Type 2 cepheids with a wide range of positions in the Galaxy and 45 classical cepheids in the Small Magellanic Cloud. Period color relations are derived for each type of cepheid and, with period magnitude relations are used to determine reddenings and distances. The colors are interpreted in terms of abundance of heavy elements, with a calibration based on observed stars with known abundances and on model atmosphere colors. The possible effects on the Washington system colors of companion stars, helium abundance variations, and peculiar reddening are discussed and are shown to be unimportant. A model for the large scale distribution of reddening material in the disk of the galaxy is constructed to fit the observations. It shows that the density of material decreases toward the outer parts of the disk. Dissert. Abstr.

N81-25005*# Hawaii Univ., Honolulu.

INFRARED AND RADIO OBSERVATIONS OF W51: ANOTHER ORION-KL AT A DISTANCE OF 7kPC

R. Genzel (Harvard-Smithsonian Center for Astrophysics), E. E. Becklin, C. G. Wynn-Williams, J. M. Moran (Harvard-Smithsonian Center for Astrophysics), M. J. Reid (Harvard-Smithsonian Center for Astrophysics), D. T. Jaffe (Harvard-Smithsonian Center for Astrophysics), and D. Downes (Institut de Radio Astronomie Millimetrique) [1981] 28 p refs

(Contract NASw-3159)

(NASA-CR-164231) Avail: NTIS HC A03/MF A01 CSCL 03A

The bright infrared sources W51-IRS2 has at least three components with different physical and evolutionary properties. The spatial distribution and the near infrared spectra of the components in IRS2 are remarkably similar to, but more luminous than those found in Orion, where an H2 region of comparable linear size is also located close to a cluster of compact infrared sources. The characteristics of the nearby W51-NORTH H2O maser source, and the detection of 2 micro m H2 quadrupole emission in IRS2 indicate that the mass loss phenomena found in Orion-KL also exist in W51. T.M.

N81-25006*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

APPLICATION OF DIGITAL IMAGE PROCESSING TECHNIQUES TO ASTRONOMICAL IMAGERY 1980

Jean J. Lorre 1 May 1981 52 p refs Sponsored by NASA Original contains color illustrations

(NASA-CR-164362; JPL-Pub-81-8) Avail: NTIS HC A04/MF A01 CSCL 03A

Topics include: (1) polar coordinate transformations (M83); (2) multispectral ratios (M82); (3) maximum entropy restoration (M87); (4) automated computation of stellar magnitudes in nebulosity; (5) color and polarization; (6) aliasing. S.F.

N81-25007# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

INFRARED SPECTROPHOTOMETER FOR THE 182 CM TELESCOPE AT CIMA EKAR (ASIAGO) [SPETTROFOTOMETRO INFRAROSSO PER IL TELESCOPIO DA 182 cm DI CIMA EKAR (ASIAGO)]

P. Baldetti, G. Ferri, D. Lorenzetti, R. Orfei, A. Pavoni, P. Saraceno, and F. Strafella (Lecce Univ., Italy) Dec. 1980 99 p refs In ITALIAN

(LPS-80-19) Avail: NTIS HC A05/MF A01

An infrared spectrophotometer built for a 182 cm IR telescope located at 1350 m above sea level in Italy is described. The instrument has an IR source modulation system at the focal plane and can be used for photometric measurements and mapping of extended sources. Among other characteristics of the instrument, the attitude control system is referred to a star in

the field of view, the detectors are designed to minimize noise signals from the secondary mirror support, and the resolution (wavelength increment devided by wavelength) is 0.01 in the interval between 1 and 5 microns. The electronic circuits used and the InSb detector are also described. Author (ESA)

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N81-25008 Stanford Univ., Calif.
ON THE HISTORY OF THE LUNAR ORBIT Ph.D. Thesis
Bruce Arthur Conway 1981 138 p
Avail: Univ. Microfilms Order No. 8108908

A frequency-dependent model of tidal fraction is used in the development of equations governing the time rate of change of the orbital elements of a satellite and the angular velocity of its tidally distorted primary. The analysis is applied to the Earth-Moon system, for which the evolution equations are integrated backwards in time yield the system history. While inclination of the lunar orbit and obliquity of the Earth remain small a linearized solution of the equations governing the precession of the rotation axis of the Earth and the normal to the lunar orbit plane is found. This solution allows averaging of the evolution equations over the precessional motion. The evolution equations are averaged also over the lunar true anomaly and the advance of the line of apsides. The orbital evolution equations consider eccentricity, the tide raised on the Earth by the Sun, the oblateness of the Earth, and terms to third order in the Earth's tidal potential. Dissert. Abstr.

N81-25009*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETIC LOOP BEHIND AN INTERPLANETARY SHOCK: VOYAGER, HELIOS AND IMP-8 OBSERVATIONS
L. Burlaga, E. Sittler, F. Mariani (Inst. di Fisica Univ., Rome), and R. Schwenn (Max-Planck-Inst. fuer Aeronomie, Katlenburg-Lindau, West Germany) Feb. 1981 47 p refs Submitted for publication
(NASA-TM-82086) Avail: NTIS HC A03/MF A01 CSCL 03B

The shock was followed by a turbulent sheath in which there were large fluctuations in both the strength and direction of the magnetic field. This in turn was followed by a region (magnetic cloud) in which the magnetic field vectors were observed to change by rotating nearly parallel to a plane, consistent with the passage of a magnetic loop. This loop extended at least 30 deg in longitude between 1-2 AU, and its radial dimension was approximately 0.5 AU. In the cloud the field strength was high and the density and temperature were relatively low. Thus, the dominant pressure in the cloud was that of the magnetic field. T.M.

N81-25010*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE ENHANCEMENT OF THE IMF MAGNITUDE DURING 1978-1979
Joseph H. King Jan. 1981 15 p refs Submitted for publication
(NASA-TM-82075) Avail: NTIS HC A02/MF A01 CSCL 03B

The magnitude of the interplanetary magnetic field (IMF) exhibits an enhancement during 1978 to 1979 relative to all years back to 1963. It is shown that IMF magnitude variations over the 1966 to 1979 period represent the combined effect of variations in both the radial flux density of the IMF and the degree of spiraling of the IMG, consistent with the theoretical model of Parker. The 1978 to 1979 IMF magnitude enhancement is due to an enhancement of radial flux which was in turn related to an increase of magnetic flux leaving solar active regions. It is also shown that during the corotating stream dominated years 1973 to 1976, the IMF was less wound up than during other years, and that 1973 to 1974 were years of enhanced radial flux. Author

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N81-25011*# National Aeronautics and Space Administration, Washington, D. C.
ADVANCES IN PLANETARY GEOLOGY
Alex Woronow, ed. Apr. 1981 261 p refs
(NASA-TM-83089) Avail: NTIS HC A12/MF A01 CSCL 03B

This second issue in a new series intended to serve the planetary geology community with a form for quick and thorough communications includes (1) a catalog of terrestrial craterform structures for northern Europe; (2) abstracts of results of the Planetary Geology Program, and (3) a list of the photographic holdings of regional planetary image facilities. A.R.H.

N81-25012*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
VIKING LANDER IMAGING INVESTIGATION DURING EXTENDED AND CONTINUATION AUTOMATIC MISSIONS. VOLUME 1: LANDER 1 PICTURE CATALOG OF EXPERIMENT DATA RECORD Final Report
Kenneth L. Jones, Mary Henshaw, Christe McMenomy, Andres Robles, Paul C. Scribner, Stephen D. Wall, and Jackson W. Wilson Apr. 1981 655 p
(NASA-RP-1068; L-14054-Vol-1) Avail: NTIS HC A99/MF A01 CSCL 03B

All images returned by Viking Lander 1 during the extended and continuation automatic phases of the Viking Mission are presented. Listings of supplemental information which describe the conditions under which the images were acquired are included together with skyline drawings which show where the images are positioned in the field of view of the cameras. Subsets of the images are listed in a variety of sequences to aid in locating images of interest. The format and organization of the digital magnetic tape storage of the images are described as well as the mission and the camera system. A.R.H.

N81-25013*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ALBEDO, INTERNAL HEAT, AND ENERGY BALANCE OF JUPITER, PRELIMINARY RESULTS OF THE VOYAGER INFRARED INVESTIGATION
R. A. Hanel, Barney J. Conrath, L. W. Herath, V. G. Kunde, and J. A. Pirraglia Sep. 1980 34 p refs Submitted for publication
(NASA-TM-80723) Avail: NTIS HC A03/MF A01 CSCL 03B

The in flight calibration of the radiometer and the Michelson interferometer of the Voyager 1 infrared instrument is discussed. The calibrated full disk measurements are applied to derive values of the albedo, the thermal emission and the global energy balance of Jupiter. M.G.

N81-25014*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VOYAGER MEASUREMENT OF THE ROTATION PERIOD OF SATURN'S MAGNETIC FIELD
M. D. Desch and M. L. Kaiser Jan. 1981 18 p refs Submitted for publication
(NASA-TM-82022; Rept-695) Avail: NTIS HC A02/MF A01 CSCL 03B

Saturn's radio rotation period was determined using measurements made by the planetary radio astronomy experiment onboard the Voyager spacecraft. The sidereal period deduced, 10 hr 39 min 24 sec ± 7 sec, is within the 10 hr to 11 hr range of optical periods derived from a century of atmospheric spot and Doppler spectroscopy observations. The radio rotation period is presumably that of the planet's magnetic field. A provisional Saturn longitude convention is proposed and equations are provided to compute a longitude ephemeris and to transform between the

proposed system and the (10 hr 14 min) system used for the Pioneer 11/Saturn encounter. The degree of longitude smearing which could result over the long term from the merging of data sets organized in this system is evaluated. No evidence of control of the radio emission by any of Saturn's satellites was found. A.R.H.

N81-25015*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE HELIUM ABUNDANCE OF JUPITER FROM VOYAGER
D. Gautier (Observatoire de Psaris-Meudon), B. Conrath, F. M. Flasar, R. A. Hanel, V. G. Kunde, A. Chedin (Lab. de Meteorologie Dynamique/LMD/du CNRS), and N. Scott (Lab. de Meteorologie Dynamique/LMD/du CNRS) Oct. 1980 37 p refs Submitted for publication
(NASA-TM-80722) Avail: NTIS HC A03/MF A01 CSCL 03B

Full disk measurements recorded 31 days before the Voyager 1 encounter with Jupiter by the radiometer of the infrared instrument, IRIS, indicate a geometric albedo of 0.274 + or - 0.013. Combining this measurement with the Pioneer derived phase integral of 1.25 and our error estimate of 0.1 yields a Jovian Bond albedo of 0.343 + or - 0.032. Infrared spectra recorded at the same time by the Michelson interferometer, along with a model extrapolation to low wave numbers not covered by the instrument, yield a thermal emission of (1.359 + or - 0.014) .001 W cm to the (-2) power. As in the case of the albedo measurement, the quoted errors in the emission measurement reflect estimates of systematic effects and are uncertain while the random component is negligible. From these measurements the internal heat flux of Jupiter is estimated to be (5.444 + or - 0.425) .0001 W cm to the (-2) power, and the energy balance defined as the ratio of emitted thermal to absorbed solar energy is 1.668 + or - 0.085. S.F.

N81-25016*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THERMAL STRUCTURE AND DYNAMICS OF THE JOVIAN ATMOSPHERE. 1: THE GREAT RED SPOT
F. Michael Flasar, Barney J. Cunrath, Joseph A. Pirraglia, Patrick C. Clark (Cornell Univ., Ithaca, N.Y.), Richard G. French (Cornell Univ., Ithaca, N.Y.), and Pater J. Gierasch (Cornell Univ., Ithaca, N.Y.) Nov. 1980 32 p refs Submitted for publication
(NASA-TM-80725) Avail: NTIS HC A03/MF A01 CSCL 03B

Temperatures and thermal winds, derived from Voyager infrared spectroscopy (IRIS) data over the Great Red Spot (GRS) and its environs, are presented. The atmosphere over the GRS is characterized by a tropopause which is cold relative to its environment and an upper stratosphere which is relatively warm. The cold tropopause implies a decrease in anticyclonic vorticity with height above 500 mb through the lower stratosphere. IRIS observations at 5 microns indicate little emission from the GRS itself, but enhanced emission in a ring about it, in agreement with recent ground based results. The behavior of the tropopause and 5 micron temperatures can be consistently interpreted as resulting from a circulation which rises within the GRS and subsides in the area around it. The explanation of the upper stratospheric temperatures is not so straightforward. A previous suggestion that they may be a manifestation of the linear vertical propagation of Rossby waves appears inconsistent with the gross east-west symmetry in the stratospheric temperatures over the GRS. The implications of the present results for various theoretical models of the GRS are examined, and the possibility that latent heat release drives the GRS is discussed. M.G.

N81-25017*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THERMAL STRUCTURE AND DYNAMICS OF THE JOVIAN ATMOSPHERE. 2: VISIBLE CLOUD FEATURES
B. J. Conrath, F. M. Flasar, J. A. Pirraglia, P. J. Gierasch (Cornell Univ., Ithaca, N.Y.), and G. E. Hunt Nov. 1980 26 p refs Submitted for publication
(NASA-TM-80724) Avail: NTIS HC A03/MF A01 CSCL 03B

Voyager IRIS data reveal strong similarities among a broad range of features which differ considerably in visual appearance. The atmosphere above anticyclonic features, including the major white ovals, the Great Red Spot, and a zone, are cold relative to the immediate surroundings in the upper troposphere and tropopause region. These results are consistent with upwelling and divergence in this part of the atmosphere. A hot spot and a barge, which are localized cyclonic features, are found to be warm relative to their surroundings, implying subsidence with accompanying convergence. In all cases, the thermal wind shear associated with the features indicates a decay of the vorticity with height in the upper troposphere and lower stratosphere. Vertical velocities inferred from the observed temperature perturbations imply an upper limit of vertical mixing times near the tropopause of approximately 20 years. Temperatures in the upper stratosphere above the anticyclonic features show considerable variation, but in most coases are found to be relatively warm. A.R.H.

N81-25018*# Cornell Univ., Ithaca, N. Y. Center for Radiophysics and Space Research.
RADAR INVESTIGATION OF ASTEROIDS Semiannual Status Report, 1 Nov. 1980 - 30 Apr. 1981
Steven J. Ostro May 1981 14 p refs
(Grant NAGw-116)
(NASA-CR-164349) Avail: NTIS HC A02/MF A01 CSCL 03B

Efforts were focused on: (1) acquisition of radar data at Arecibo; (2) examination of raw data; (3) reduction of the unmodulated data to background-free, calibrated spectra; (4) integration and coherent analyses of the phase-coded data; and (5) calculation of Doppler shifts and preliminary values for echo limb-to-limb bandwidths, radar cross sections, and circular polarization ratios. Asteroids observed to data have radar properties distinct from those of the rocky terrestrial planets and those of the icy Galilean satellites. S.F.

N81-25019# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
THE SATELLITES OF JUPITER AS A SOURCE OF VERY ENERGETIC MAGNETOSPHERIC PARTICLES
J. B. Blake and M. Schulz 15 Dec. 1980 23 p refs
(ATR-81(8454)-1) Avail: NTIS HC A02/MF A01

The Jovian satellites and ring are continuously bombarded by high energy galactic cosmic rays and magnetospheric ions. Nuclear interactions will create very energetic neutrons and pions. The decay of some of these unstable particles within the Jovian magnetosphere will result in trapped protons and ultra-relativistic electrons and positrons. Although this source is weak compared to those that yield lower-energy magnetospheric particles, it is expected to generate the most Jovian particles. These processes are briefly described. Author

N81-24138*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE STATUS OF COMETARY SCIENCE
Fred L. Whipple *In* NASA. Marshall Space Flight Center Proc. of the Shuttle-Based Cometary Sci. Workshop 1976 p 169-190 refs (For primary document see N81-24128 15-12)
(Grant NsG-7082)
Avail: NTIS HC A12/MF A01 CSCL 03B

N81-24140*# Colorado Univ. at Boulder.
ULTRAVIOLET SPECTROSCOPY OF COMETS
Charles F. Lillie *In* NASA. Marshall Space Flight Center Proc. of the Shuttle-Based Cometary Sci. Workshop 1976 p 205-221 refs (For primary document see N81-24128 15-12)
Avail: NTIS HC A12/MF A01 CSCL 03B

N81-24141*# Centre National de la Recherche Scientifique, Verrieres-le-Buisson (France). Service d'Aeronomie.
OH OBSERVATIONS
Michel Festou *In* NASA. Marshall Space Flight Center Proc. of the Shuttle-Based Cometary Sci. Workshop 1976 p 222-226 refs (For primary document see N81-24128 15-12)
Avail: NTIS HC A12/MF A01 CSCL 03B

N81-24142*# Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
HYDROGEN LYMAN ALPHA OBSERVATIONS

H. U. Keller *In* NASA. Marshall Space Flight Center Proc. of the Shuttle-Based Cometary Sci. Workshop 1976 p 227-237 refs (For primary document see N81-24128 15-12)
Avail: NTIS HC A12/MF A01 CSCL 03B

N81-24143*# California Univ., San Diego, La Jolla. Dept. of Applied Physics and Information Science.
THE STUDY OF COMETARY PLASMAS USING ARTIFICIAL COMETS LAUNCHED FROM THE SPACE SHUTTLE
D. A. Mendis *In* NASA. Marshall Space Flight Center Proc. of the Shuttle-Based Cometary Sci. Workshop 1976 p 238-248 refs (For primary document see N81-24128 15-12)
(Grants NsG-7102; NGR-05-009-110; NSF MPS-74-23501; NSF MPS-74-21195)
Avail: NTIS HC A12/MF A01 CSCL 03B

N81-24144*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE HALLEY RENDEZVOUS VIA SOLAR SAILING MISSION DESCRIPTION
L. D. Friedman *In its* Proc. of the Shuttle-Based Cometary Sci. Workshop 1976 p 251-256 (For primary document see N81-24128 15-12)
Avail: NTIS HC A12/MF A01 CSCL 03B

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N81-25020*# Maryland Univ., College Park.
CONTRIBUTIONS TO THE 17TH INTERNATIONAL CONFERENCE ON COSMIC RAYS
1981 28 p refs Proposed for presentation at Paris, Jul. 1981
(Contract NAS5-20062)
(NASA-CR-164344; PP-81-205) Avail: NTIS HC A03/MF A01 CSCL 03B

Charged particle events occurring in solar flares are discussed, with emphasis on heavy ion abundances, particle acceleration and particle transport. S.F.

N81-25021*# Maryland Univ., College Park.
OBSERVATIONS OF INTERPLANETARY ENERGETIC CHARGED PARTICLES FROM GAMMA-RAY LINE SOLAR FLARES
M. E. Pesses, B. Klecker (Max-Planck-Inst. fuer Extraterrestrische Physik, Garching, West Germany), G. Gloeckler, and D. Hovestadt (Max-Planck-Inst. fuer Extraterrestrische Physik, Garching, West Germany) *In its* Contrib. to the 17th Intern. Conf. on Cosmic Rays 1981 p 1-4 refs (For primary document see N81-25020 15-92)
Avail: NTIS HC A03/MF A01 CSCL 03B

Observations of interplanetary energetic ions from the 7 June, 21 June and 1 July 1980 gamma ray line solar flares are presented. The observations are from the Max-Planck-Institut/University of Maryland Ultra Low Energy Wide Angle Telescope aboard the ISEE-3 spacecraft. Both June flares produced relatively low intensity proton events at earth with peak intensities at 10-20 MeV approximately 5 x .01 protons square cm sec sr MeV)-1. Neither flare showed evidence of being enriched in either 3He or Fe at approximately 1 MeV/nucleon. The 1 July flare produced no observable ion or electron enhancements. S.F.

N81-25022*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
TIME AND ENERGY DEPENDENCE OF HEAVY ION ABUNDANCES IN SOLAR FLARE ENERGETIC PARTICLE EVENTS
G. M. Mason, H. Weiss, G. Gloeckler, and D. Hovestadt (Max-Planck-Inst. fuer Physik und Astrophysik, Munich) *In its* Contrib. to the 17th Intern. Conf. on Cosmic Rays 1981 p 5-8 refs (For primary document see N81-25020 15-92)
Avail: NTIS HC A03/MF A01 CSCL 03B

Examples are presented of the time and energy dependence of the abundances and spectra of the major heavy ions He, C, O and Fe during solar flare events, taken from a survey using the UMD/MPI ULET telescope on IMP-8 during 1973-1977. In some cases, time variations were found in the O/He, O/C and Fe/O ratios which appear to be inconsistent with models based solely on rigidity dependent propagation in the interplanetary medium. Author

N81-25023*# Maryland Univ., College Park.
OBSERVATIONS OF THE IONIZATION STATES OF ENERGETIC PARTICLES ACCELERATED IN SOLAR FLARES
G. Gloeckler, H. Weiss, D. Hovestadt (Max-Planck-Inst. fuer Extraterrestrische Physik, Garching), F. M. Ipavich, B. Klecker (Max-Planck-Inst. fuer Extraterrestrische Physik, Garching), L. A. Fisk (New Hampshire Univ.), M. Scholer (Max-Planck-Inst. fuer Extraterrestrische Physik, Garching), C. Y. Fan (Ariz. Univ.), and J. J. OGallagher (Chicago Univ.) *In its* Contrib. to the 17th Intern. Conf. on Cosmic Rays 1981 p 10-13 refs Sponsored in part by Bundesministerium fuer Forschung und Technologie (For primary document see N81-25020 15-92)
(Grants NGR-21-002-224; NGR-21-002-316)
Avail: NTIS HC A03/MF A01 CSCL 03B

Results of a survey of ten solar flare particle events, in which the ionization states and spectra of 0.3 to 2.4 MeV/nuc He, C, O and Fe were measured, are reported. He+ was present in all events (He+/He++ approximately 0.1 to 0.25), and the mean ionization states of C, O and Fe are high. The distribution functions of He+, He++ and heavier elements are well represented by simple exponentials of the particle speed times its rigidity to a power n, where n is between 0 and 1, and equal e-folding values. Results are consistent with a model whereby ions are accelerated in the corona by multi-dimensional shocks out of a population taken from both hot and cold coronal regions. Author

N81-25024*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
EVOLUTION OF THE ENERGETIC PARTICLE COMPOSITION DURING SOLAR FLARE EVENTS AS OBSERVED BY VOYAGER 1 AND 2
D. C. Hamilton and G. Gloeckler *In its* Contrib. to the 17th Intern. Conf. on Cosmic Rays 1981 p 14 ref (For primary document see N81-25020 15-92)
Avail: NTIS HC A03/MF A01

Measurements of the composition and energy spectra of the energetic ions from two solar flare particle events are presented. Their evolution with time during each event is discussed. The data are from the Low Energy Particle Telescope (LEPT) on Voyager 2, which can identify the major ion species (Z = 1-26) over an energy range of approximately 0.5-50 MeV/nucleon. Author

N81-25025*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
ON THE ANTICORRELATION BETWEEN THE He-3/He-4 RATIO AND PROTON INTENSITY IN He-3 RICH FLARES
M. E. Pesses *In its* Contrib. to the 17th Inter. Conf. on Cosmic Rays 1981 p 15-18 refs (For primary document see N81-25020 15-92)
Avail: NTIS HC A03/MF A01 CSCL 03B

A model is presented which can explain the observed anticorrelation between the size of the 3He/4He abundance ratio at greater than or approximately 10 MeV/nuc and the peak intensity of approximately 10 MeV protons in 3He rich events. If 3He is preaccelerated with respect to 4He prior to the main ion acceleration phase, and if the main ion acceleration phase has an effective injection cutoff which varies from flare to flare, the observed anticorrelation follows naturally. Author

N81-25026*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
ANALYTICAL DESCRIPTION OF CHARGED PARTICLES TRANSPORT ALONG ARBITRARY GUIDING-FIELD CONFIGURATIONS
J. A. Earl *In its* Contrib. to the 17th Intern. Conf. on Cosmic Rays 1981 p 19-22 refs Sponsored in part by Alexander von Humboldt Foundation (For primary document see N81-25020

15-92)
(Grant NGR-21-002-066)
Avail: NTIS HC A03/MF A01 CSCL 03B

A new description of focused transport was developed which is valid for arbitrary spatial dependences of both the scattering mean free path and the focusing length. In particular, it describes the supercoherent transition from the coherent modes that occurs when focusing is strong compared to scattering to the diffusive mode that occurs when focusing is weak. Because it specifies the pitch angle distribution in terms of relatively simple functions, the new formulation facilitates not only the detailed interpretation of solar particle events, but also the qualitative understanding of focused transport. In the steady state, it predicts that the angular distribution consists of a highly collimated 'strahl' which is superimposed on an anisotropic 'halo'. This picture provides new insight into observed configurations of steady-state particle fluxes. Author

N81-25027*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
A SUPRA-THERMAL ENERGETIC PARTICLE DETECTOR (STEP) FOR COMPOSITION MEASUREMENTS IN THE RANGE APPROXIMATELY 20 keV/NUCLEON TO 1 MeV/NUCLEON
G. M. Mason and G. Gloeckler *In its* Contrib. to the 17th Intern. Conf. on Cosmic Rays 1981 p 23-26 refs (For primary document see N81-25020 15-92)
(Grants NGR-21-002-224; NGR-21-002-316; Contracts JPL-955126; JPL-955460; JPL-955517)
Avail: NTIS HC A03/MF A01 CSCL 03B

A detector system is described, employing a time-of-flight versus residual energy technique which allows measurement of particle composition (H-Fe), energy spectral and anisotropies in an energy range unaccessible with previously flown sensors. Applications of this method to measurements of the solar wind ion composition are discussed. Author

N81-25028*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPECTRAL DISTRIBUTION OF SOLAR RADIATION
Ann Thomas Mecherikunnel and Joseph Richmond Sep. 1980 93 p refs
(NASA-TM-82021) Avail: NTIS HC A05/MF A01 CSCL 03B

Available quantitative data on solar total and spectral irradiance are examined in the context of utilization of solar irradiance for terrestrial applications of solar energy. The extraterrestrial solar total and spectral irradiance values are also reviewed. Computed values of solar spectral irradiance at ground level for different air mass values and various levels of atmospheric pollution or turbidity are presented. Wavelengths are given for computation of solar, absorptance, transmittance and reflectance by the 100 selected-ordinate method and by the 50 selected-ordinate method for air mass 1.5 and 2 solar spectral irradiance for the four levels of atmospheric pollution.
A.R.H.

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N81-25029*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CONTRIBUTIONS TO THE 17TH INTERNATIONAL COSMIC RAY CONFERENCE
Apr. 1981 9 p refs
(NASA-TM-82132) Avail: NTIS HC A02/MF A01 CSCL 03B

The propagation and transport of cosmic rays are investigated. The role of magnetic helicity is explored. S.F.

N81-25030*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DETERMINATION OF MAGNETIC HELICITY IN THE SOLAR WIND AND IMPLICATIONS FOR COSMIC RAY PROPAGATION
William H. Matthaeus and Melvyn L. Goldstein *In its* Contrib. to the 17th Intern. Cosmic Ray Conf. Apr. 1981 p 2-4 refs (For primary document see N81-25029 15-93)
Avail: NTIS HC A02/MF A01 CSCL 03B

The mean value of the correlation between local magnetic field and vector potential, known as the magnetic helicity, is a measure of the lack of mirror reflection symmetry of magnetic covariances in a turbulent medium. A method is presented for extraction of helicity spectra from magnetometer data, and applied to an evaluation of the magnetic helicity of interplanetary magnetic fluctuations. S.F.

N81-25031*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ROLE OF MAGNETIC HELICITY IN COSMIC RAY TRANSPORT THEORY
Melvyn L. Goldstein and William H. Matthaeus *In its* Contrib. to the 17th Intern. Cosmic Ray Conf. Apr. 1981 p 5-8 refs (For primary document see N81-25029 15-93)
Avail: NTIS HC A02/MF A01 CSCL 03B

The pitch angle scattering of cosmic ray is modified greatly if the medium through which they propagate contains significant amounts of magnetic helicity. When helicity is present in the medium, the often used expression for the pitch angle diffusion coefficient derived from quasilinear theory must be modified. These modifications are illustrated for slab and isotropic symmetries. Using measurements of helicity in the solar wind determined from single point measurements of the correlation tensor of magnetic fluctuations obtained from Voyager 2, the effects of the observed helicity on both the pitch angle and spatial diffusion coefficients are estimated. Author

N81-25032*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
COSMIC RAY DRIFT, SHOCK WAVE ACCELERATION AND THE ANOMALOUS COMPONENT OF COSMIC RAYS
M. E. Pesses, J. R. Jokipii (Arizona Univ.), and D. Eichler 1981 17 p refs
(Grants NGR-21-002-224; NsG-7101; NSF ASP-800-2673; NSF ATM-220-18)
(NASA-CR-164345; PP-81-152) Avail: NTIS HC A02/MF A01 CSCL 09B

A model of the anomalous component of the quiet-time cosmic ray flux is presented in which ex-interstellar neutral particles are accelerated continuously in the polar regions of the solar-wind termination shock, and then drift into the equatorial regions of the inner heliosphere. The observed solar-cycle variations, radial gradient, and apparent latitude gradient of the anomalous component are a natural consequence of this model. Author

N81-25033*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GAMMA RAY LINES FROM THE GALACTIC CENTER AND GAMMA RAY TRANSIENTS
R. Ramaty, D. Leiter, and R. E. Lingenfelter Apr. 1981 23 p refs Submitted for publication
(NASA-TM-82125) Avail: NTIS HC A02/MF A01 CSCL 03B

The observations and interpretations of cosmic (nonsolar) gamma ray lines are discussed. The most prominent of these lines is the e(+)e(-) annihilation line which was observed from the Galactic Center and from several gamma ray transients. At the Galactic Center the e(+)e(-) pairs are probably produced by an accreting massive black hole (solar mass of approximately one million) and annihilate within the central light year to produce a line at almost exactly 0.511 MeV. In gamma ray transients the annihilation line is redshifted by factors consistent with neutron star surface redshifts. Other observed transient gamma ray lines appear to be due to cyclotron absorption in the strong magnetic fields of neutron stars, and nuclear deexcitations and neutron capture, which could also occur on or around these objects.
M.G.

99 GENERAL

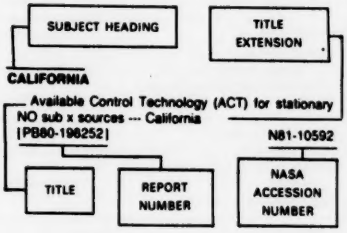
N81-25034# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

[AEROSPACE RESEARCH ACTIVITIES AND ITS FACILITIES, 1979] Annual Report

28 May 1980 220 p refs Original contains color illustrations Avail: NTIS HC A10/MF A01

Research activities highlighted include investigations, control configured aircraft, guidance and propulsion of missiles, and military lasers as well as numerical studies and theoretical work to supplement wind tunnel testing of aircraft, helicopters, missiles and turbomachinery. Structural design, aeroelasticity, and fracture mechanics research, thermal modeling of turbomachines and chemical propulsion mechanisms were also of interest. Aircraft noise propagation, electrostatic disturbances on aircraft, and minor constituents in the stratosphere were measured. Ordered eutectics, metallic felts, powder metallurgy of titanium alloys, and composite as well as ablative materials were studied. Author (ESA)

Typical Subject Index Listing



The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7050).

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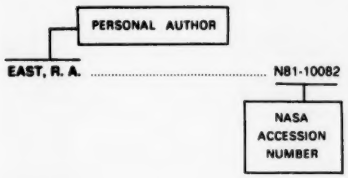

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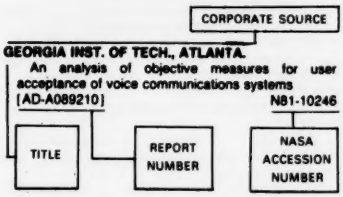

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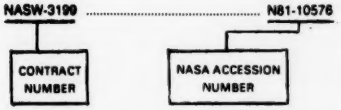

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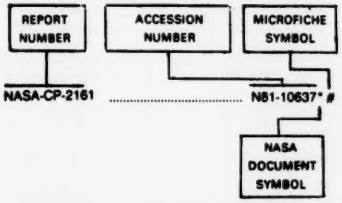

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NASA-TM-80723 ..... N81-25013*#
NASA-TM-80724 ..... N81-25017*#
NASA-TM-80725 ..... N81-25016*#
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NASA-TM-81802 ..... N81-24115*#
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NASA-TM-81993 ..... N81-24497*#
NASA-TM-81996 ..... N81-24503*#
NASA-TM-82002 ..... N81-24495*#
NASA-TM-82016 ..... N81-24829*#
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NASA-TM-82022 ..... N81-25014*#
NASA-TM-82067 ..... N81-24501*#
NASA-TM-82068 ..... N81-24502*#
NASA-TM-82071 ..... N81-24499*#
NASA-TM-82072 ..... N81-24648*#
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NASA-TM-82086 ..... N81-25009*#
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NASA-TM-82097 ..... N81-24674*
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NASA-TM-82102 ..... N81-24801*#
NASA-TM-82117 ..... N81-24504*#
NASA-TM-82124 ..... N81-24925*#
NASA-TM-82125 ..... N81-25033*#
NASA-TM-82132 ..... N81-25029*#
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NASA-TM-82333 ..... N81-24162*#
NASA-TM-82352 ..... N81-24389*#
NASA-TM-82355 ..... N81-24152*#
NASA-TM-82416 ..... N81-24680*#
NASA-TM-82417 ..... N81-24651*#
NASA-TM-82418 ..... N81-24908*#
NASA-TM-82420 ..... N81-24302*#
NASA-TM-82421 ..... N81-24161*#
NASA-TM-82422 ..... N81-24845*#
NASA-TM-82601 ..... N81-24539*#
NASA-TM-82607 ..... N81-24534*#
NASA-TM-82615 ..... N81-24994*#
NASA-TM-82621 ..... N81-24926*#
NASA-TM-82624 ..... N81-24533*#
NASA-TM-83089 ..... N81-25011*#
NASA-TM-83109 ..... N81-24416*#
NASA-TM-83110 ..... N81-24113*#
NASA-TM-83116 ..... N81-24415*#

NASA-TP-1768 ..... N81-24283*#
NASA-TP-1792 ..... N81-24387*#
NASA-TP-1801 ..... N81-24601*#
NASA-TP-1816 ..... N81-24854*#
NASA-TP-1841 ..... N81-24388*#
NASA-TP-1842 ..... N81-24065*#
NASA-TP-1854 ..... N81-24058*#
NASA-TP-1855 ..... N81-24048*#
NASA-TP-1861 ..... N81-24022*#
NASA-TP-1862 ..... N81-24178*#
NASA-TP-1863 ..... N81-24471*#
NASA-TP-1867 ..... N81-24179*#
NASA-TP-1873 ..... N81-24167*#

NBS-SP-500-73 ..... N81-24750*#

NBSIR-81-2230 ..... N81-24966*#

ND-R-512(S) ..... N81-24473*#

NEAR-TR-224 ..... N81-24032*#
NEAR-TR-232 ..... N81-24021*#

NEPRF-CR-80-05 ..... N81-24689*#

NEPRF-TR-80-06 ..... N81-24685*#

NF-86/8-79 ..... N81-24389*#

NIAST-80/19 ..... N81-24116*#
NIAST-80/52 ..... N81-24107*#

NLR-MP-80007-U ..... N81-24813*#

NOAA-TR-ERL-412 ..... N81-24704*#

NOAA-80110707 ..... N81-24673*#
NOAA-80120402 ..... N81-24704*#
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NOSC-TR-651 ..... N81-24358*#

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NRL-MR-4401 ..... N81-24882*#
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NRL-MR-4493 ..... N81-24432*#
NRL-MR-4498 ..... N81-24930*#
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NRL-R-8467 ..... N81-24331*#

NSF/RA-800044 ..... N81-24617*#
NSF/RA-800231 ..... N81-24279*#
NSF/RA-800260 ..... N81-24998*#
NSF/RA-800261 ..... N81-24999*#
NSF/RA-800262 ..... N81-25000*#
NSF/RA-800268 ..... N81-24984*#
NSF/RA-800304 ..... N81-24672*#
NSF/RA-800307 ..... N81-24254*#
NSF/RA-800308 ..... N81-24976*#
NSF/RA-800310 ..... N81-24975*#
NSF/RA-800311 ..... N81-24315*#
NSF/RA-800312 ..... N81-24217*#
NSF/RA-800317 ..... N81-24215*#
NSF/RA-800327 ..... N81-24518*#
NSF/RA-800334 ..... N81-24732*#
NSF/RA-800356 ..... N81-24337*#

NSWC/TR-80-290 ..... N81-24184*#
NSWC/TR-80-455 ..... N81-24544*#
NSWC/TR-81-4 ..... N81-24043*#

NUSC-TR-6403 ..... N81-24839*#

NWC-TP-6226 ..... N81-24155*#

NYSERDA-79-9 ..... N81-24516*#

O-NO4-101-50 ..... N81-24617*#

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ONR-243-027-009 ..... N81-24971*#
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ONRL-C-13-80 ..... N81-24543*#

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ORNL/TM-7561 ..... N81-24553*#

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PB81-134744 ..... N81-24999 #
PB81-134751 ..... N81-25000 #
PB81-135170 ..... N81-24984 #
PB81-135352 ..... N81-24704 #
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PB81-141764 ..... N81-24777 #
PB81-146797 ..... N81-24315 #
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PB81-147407 ..... N81-24219 #
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PB81-148090 ..... N81-24518 #
PB81-148140 ..... N81-24253 #
PB81-148157 ..... N81-24214 #
PB81-148207 ..... N81-24619 #
PB81-148256 ..... N81-24457 #
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PB81-148421 ..... N81-24279 #
PB81-148926 ..... N81-24217 #
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PB81-148959 ..... N81-24215 #
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PB81-150039 ..... N81-24220 #
PB81-150120 ..... N81-24278 #
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PB81-150302 ..... N81-24976 #
PB81-150310 ..... N81-24672 #
PB81-150831 ..... N81-24514 #
PB81-150955 ..... N81-24515 #
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PB81-153926 ..... N81-24595 #
PB81-154320 ..... N81-24624 #
PB81-154726 ..... N81-24310 #
PB81-154957 ..... N81-24705 #
PB81-155061 ..... N81-24511 #
PB81-156002 ..... N81-24313 #
PB81-156010 ..... N81-24314 #
PB81-158941 ..... N81-24990 #
PB81-160087 ..... N81-24618 #
PB81-169831 ..... N81-24594 #

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PML-1978-22 ..... N81-24213 #

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PNL-SA-8425 ..... N81-24611 #
PNL-SA-8875 ..... N81-24696 #
PNL-SA-8901 ..... N81-24610 #
PNL-SA-8939 ..... N81-24243 #

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PNL-3195-WERA-10 ..... N81-24692 #
PNL-3695 ..... N81-24583 #

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PP-81-205 ..... N81-25020* #

PRI-17 ..... N81-24435 #

PUBL-228 ..... N81-24402 #
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PWA-5706-16 ..... N81-24067* #

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P81-10060 ..... N81-24151*

QPR-3 ..... N81-24307 #

QR-9 ..... N81-24238 #
QR-9 ..... N81-24245 #

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R-63 ..... N81-24668 #
R-1433 ..... N81-24232 #
R-1434 ..... N81-24233 #
R-1435 ..... N81-24851 #

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RAD-80-203-003-05 ..... N81-24616 #

RADC-TR-80-87 ..... N81-24909 #
RADC-TR-80-358 ..... N81-24911 #
RADC-TR-80-374-VOL-1 ..... N81-24764 #
RADC-TR-80-374-VOL-2 ..... N81-24764 #
RADC-TR-80-410 ..... N81-24330 #
RADC-TR-81-8 ..... N81-24153 #
RADC-TR-81-10 ..... N81-24748 #
RADC-TR-81-13 ..... N81-24913 #
RADC-TR-81-14 ..... N81-24832 #

RAND/N-1645-ARPA ..... N81-24790 #

RCI-TR-005 ..... N81-24529* #

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REPT-2 ..... N81-24999 #
REPT-2-53020/1R-52637 ..... N81-24148* #
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REPT-80-127 ..... N81-24938 #
REPT-81-0209 ..... N81-24354 #
REPT-81-0210 ..... N81-24355 #
REPT-138 ..... N81-24312 #
REPT-695 ..... N81-25014* #
REPT-1310-R-0020 ..... N81-24360 #
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RFP-3138 ..... N81-24895 #

RI/RD80-220 ..... N81-24070 #

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RR-81-2 ..... N81-24838 #
RR-121 ..... N81-24786 #
RR-138 ..... N81-24312 #
RR-185 ..... N81-24803 #

RSC-3712-12 ..... N81-24492* #

R81-912545-61 ..... N81-24181* #
R81AEG208 ..... N81-24180* #

S-REPT-97-100 ..... N81-24991 #

S-989-81-01 ..... N81-24162* #

SAI-1-227-00-413-00 ..... N81-24881 #
SAI-81-240-WA ..... N81-24703 #
SAI-254-80-626-LJ ..... N81-24435 #

SAN-1202-8 ..... N81-24548 #

SAND-80-1578C ..... N81-24565 #
SAND-81-0139C ..... N81-24363 #
SAND-81-0442C ..... N81-24419 #

SAPR-1 ..... N81-24578 #

SAR-FR-80-60024 ..... N81-24931 #

SASR-8 ..... N81-24650* #

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SD-TR-81-12 ..... N81-24154 #
SD-TR-81-14 ..... N81-24429 #
SD-TR-81-18 ..... N81-24428 #
SD-TR-81-30 ..... N81-24433 #

SERI/TP-333-605 ..... N81-24573 #
SERI/TP-721-1031 ..... N81-24554 #

SERI/TR-8272-1-T1 ..... N81-24559 #

SM-GO-04018 ..... N81-24495* #

SM-G1-04050 ..... N81-24494* #

SMU-EE-TR-81-9 ..... N81-24772 #

SNIAS-802-111-102 ..... N81-24110 #
SNIAS-802-111-107 ..... N81-24482 #
SNIAS-802-111-108 ..... N81-24054 #
SNIAS-802-111-110 ..... N81-24308 #
SNIAS-802-111-111 ..... N81-24055 #
SNIAS-802-111-112 ..... N81-24056 #
SNIAS-802-111-113 ..... N81-24057 #
SNIAS-802-111-114 ..... N81-24061 #
SNIAS-802-111-115 ..... N81-24062 #

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SR-2 ..... N81-24617 #
SR-2 ..... N81-24659 #
SR-2 ..... N81-24918 #
SR-2 ..... N81-24931 #

SRBI-R-4828-16 ..... N81-24068* #

SRI-MP-81-72 ..... N81-24884 #

SRO-0005-1 ..... N81-24353 #

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TE4247-193-81 ..... N81-24528* #

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TN-RT/119 ..... N81-24375 #

TNO-908.835 ..... N81-24867 #

TN0-808.780/2 ..... N81-24866 #

TPD-808.720 ..... N81-24865 #

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TR-D-50-ARO ..... N81-24804 #

TR-1 ..... N81-24968 #
TR-3 ..... N81-24232 #
TR-3 ..... N81-24233 #
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TR-19 ..... N81-24879 #
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TR-222 ..... N81-24810 #
TR-550 ..... N81-24326 #
TR-0081(6505-02)-1 ..... N81-24154 #
TR-0081(6606)-1 ..... N81-24429 #
TR-0081(6623)-1 ..... N81-24395 #
TR-0081(6930-03)-1 ..... N81-24428 #
TR-0081(6930-03)-2 ..... N81-24433 #
TR-0081(6930-04)-2 ..... N81-24434 #
TR-1007 ..... N81-24768 #
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TRB/NCHRP/REP-225 ..... N81-24314 #
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TRITA-EPP-80-01 ..... N81-24940 #

TUM-RT-KB-80/2 ..... N81-24898 #

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UCID-18712 ..... N81-24935 #
UCID-18902 ..... N81-24305 #
UCID-18909-VOL-1 ..... N81-24289 #
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UCLA-ENG-8015 ..... N81-24310 #
UCLA-ENG-8043 ..... N81-24234 #

UCLA-12-1289 ..... N81-24710 #

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UCRL-15321-VOL-2 ..... N81-24397 #
UCRL-84445-REV-1 ..... N81-24562 #
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